

SITE INSPECTION WORKSHEET

(Region I version 6/30/95)

WARNING!!

EPA has determined that the HRS score of any site that is progressing towards listing on the NPL is confidential. Deliberations regarding scoring or listing issues, the site specific status, and HRS scores cannot be released or discussed with non-Agency persons. For additional guidance see the April 30, 1993 OSWER Directive 9320.1-11.

SITE LOCATION

Site Name: Roy Bros Haulers

Street Address: 764 Boston Road

City: Billerica

State: MA

Zip

Code: 01866

Telephone:

508-667-1921

CERCLIS ID No.: MAD009870643

Coordinates: Latitude: 42°32'06"N

Longitude: 71°14'09.5"W

OWNER/OPERATOR IDENTIFICATION

Owner: Roy Bros Inc.

Operator: Leo Roy

Owner Address: 764 Boston Road

Operator Address: 764 Boston Road

City: Billerica

City: Billerica

State: MA

Zip Code:

01866

Telephone:

508-667-1921

State: MA

Zip Code:

01866

Telephone:

508-667-1921

SITE EVALUATION

Agency/Organization: START

TDD No.: 95-06-0006

Investigator: Jack Padden

Date: 11 July 1996

EPA CONTACT

EPA SAM: Ms. Nancy Smith

Address: JFK Federal Building

City: Boston

State: MA

Zip Code:

02203

Telephone: (617) 573-9697

EPA Reviewer:

Date:



SEMS DocID

657611

GENERAL INFORMATION

Site Description and Operational History: Provide a brief description of the site and its operational history. State the site name, owner, operator, type of facility and operations, size of property, active or inactive status, and years of waste generation. Summarize waste treatment, storage, or disposal activities that have or may have occurred at the site; note whether these activities are documented or alleged. Identify all source types and prior spills, floods, or fires. Summarize highlights of the PA and other investigations. Cite references.

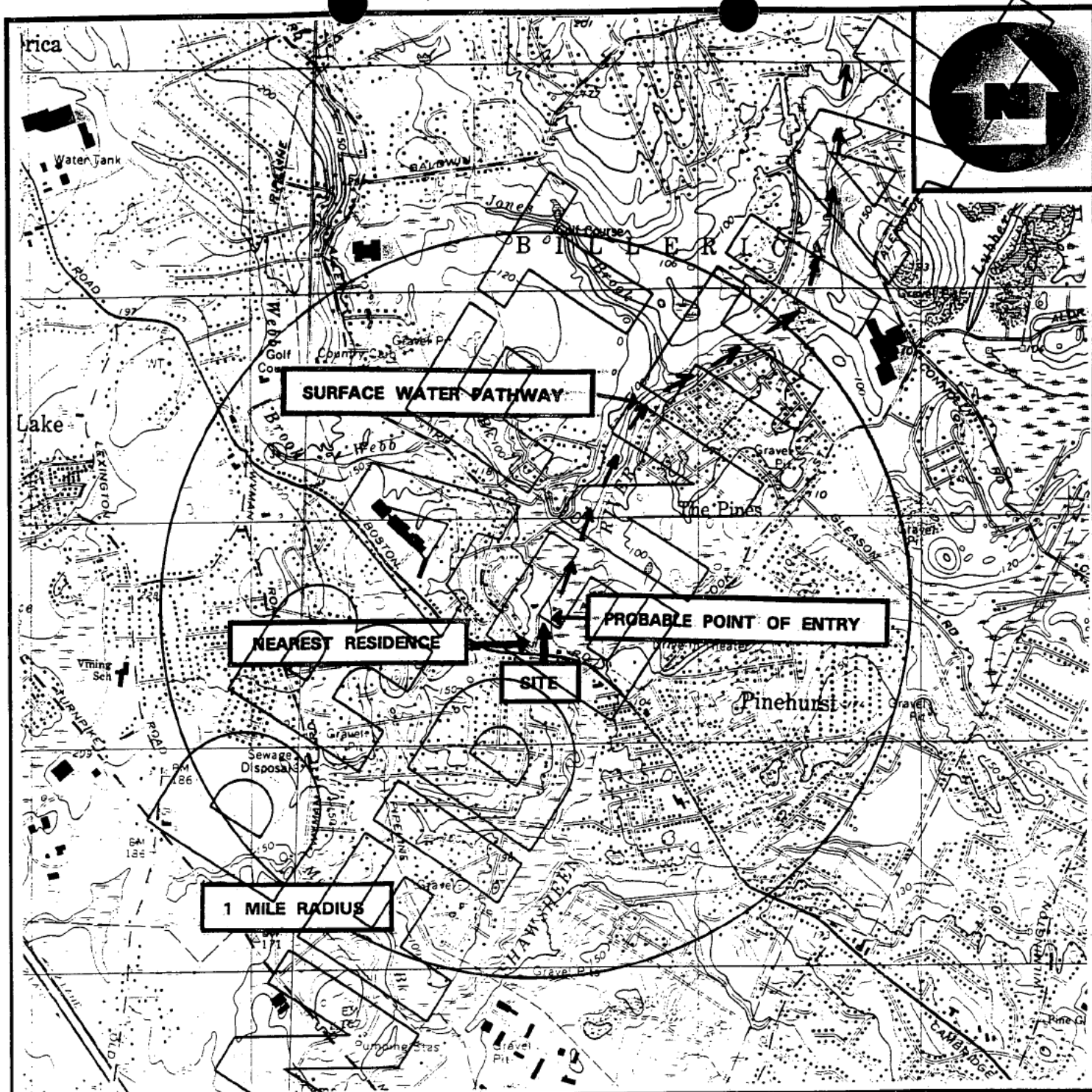
The Roy Bros Haulers (Roy Bros) property is located at 764 Boston Road in Billerica, Middlesex County, Massachusetts at latitude 42°32'06" north and longitude 71°14'09.5" west. The Roy Bros property consists of two parcels; Billerica Tax Assessor's Map parcels 25 and 217 on plate 90 (Figures 1 and 2) [50].

Roy Bros is owned by Messrs. Leo, Arthur, and Maurice Roy. The 4.4-acre property consists of an active chemical hauling operation; sparsely vegetated areas of former hazardous waste disposal and burn areas; and tanker and scrap storage locations. One building is located on the property [2, pp. 12-14].

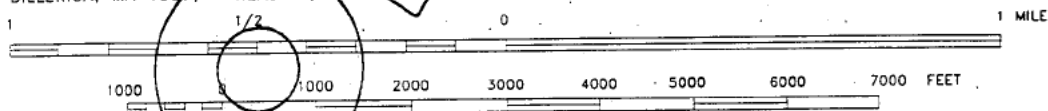
On 20 September 1995, START personnel performed an on-site reconnaissance of the Roy Bros property. The building houses the Roy Bros offices, two truck rinsing bays, a garage bay for truck repairs, and the on-site waste treatment facilities. The waste treatment facilities consist of two holding tanks, two oil separators, a filtration tank, and a deionizing filter. The clamshell of a backhoe is used to catch the effluent sludge removed by the deionizing filter and is disposed of by a hazardous waste hauler. In the rinsing bays, floor drains collect and route the washwater and excess detergent and through the treatment process. Two fire cabinets containing fifteen to twenty 1-gallon paint cans are located in the building. A temporary drum storage area is also located within the building. The current inventory of the storage area is as follows: three 55-gallon drums of methyl ethyl ketone, two 55-gallon drums of ethyl acetate, four 55-gallon drums of sulfuric acid, and two 55-gallon drums of caustic potash. The drums are stored undercover on wooden pallets on a concrete floor. Potential spills are contained by a two-inch wide concrete trough. The contents of the trough flow into the rinsing bays and the treatment system [2, pp. 5-12].

From the southern edge of the property and extending to the southern side of the building, an 100-foot wide strip of the property is paved and used for temporary storage of tankers. The paved area continues around the eastern and northern sides of the building. These paved areas extend approximately 50 feet from the building. Empty tankers line the eastern edge of the property. These tankers are stored off the paved area. The property beneath the tankers is sparsely vegetated [2, p. 7].

North of the building, a empty tanker serves as an above-ground storage tank (AST) for leftover tank residue. The AST is a double-walled tank missing several exterior panels. Only two sides of the AST display proper labels for hazardous waste storage. Several dents in the sides of the AST were visible. The AST is raised on blocks within an uncovered steel moat. The area of the steel moat is 525 square feet (ft²). Within the moat, standing water with a stained, red tint was observed. An open drainage pipe outfall lies at surface level in the northwest corner of the moat. A 1-ft² area of stained soil is adjacent to the outfall pipe [2, p. 11].



BASE MAP IS A PORTION OF THE FOLLOWING 7.5 X 15' U.S.G.S. QUADRANGLE(S):
 BILLERICA, MA 1987; READING, MA 1987



QUADRANGLE LOCATION

LOCATION MAP

ROY BROS HAULERS
 764 BOSTON ROAD
 BILLERICA, MASSACHUSETTS



REGION I SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM

TDD #
 95-06-0006

DRAWN BY:
 J. PADDEN

DATE
 05 MAY 1996

FILE NAME:
 S:\95060006\FIG1.DWG

FIGURE 1

GENERAL INFORMATION (Continued)

A 4,400-ft² area of blackened surficial soil was observed south of the former eastern lagoon area. This area was reportedly the recent location for a short-term sandblasting operation. A storage trailer north of the building contained bags of "Black Beauty," a sand blasting material. The constituents of this blackened soil and "Black Beauty" could not be determined [2, p. 11].

A "burn area" of approximately 5,600-ft² was located between the building and the former eastern lagoon. In this area, debris ranging from oil filters to office supplies were deposited into a trench and burned [2, pp. 2-12]. The extent and period of use of this disposal area is unknown.

Seven monitoring wells are located on the Roy Bros property. Well Nos. 1, 2, and 3 were located adjacent to the abutting wetlands along the eastern border of the property. Well Nos. 1 and 2 have flushmounts and appear to have questionable seals. The exact location and present condition of Well No. 3 are unknown. Well Nos. 4 and 5 are in poor condition and located in the vicinity of the former eastern and western lagoon areas, respectively. Well No. 6 is located east of the moat approximately 15 feet north of the building. Well No. 6 is locked and appeared in good condition. Near Well No. 6, two soil gas pit vents extend out of the ground. A steel cover provides shelter to the two vents. Located downgradient of Well No. 6, Well No. 7 is locked and appeared in good condition [2, pp. 3-12].

The property is easily accessible to the public. No visible security measures or barriers to access exist other than the neighboring wetlands which provide a natural barrier to access on the northern and eastern boundaries of the property. The nearest residence to the property is located on the western boundary of the property, 210 feet southwest of the former western lagoon area [2, p. 12]. The nearest school, the Ditson School, is located on Boston Road, approximately 0.6 miles southeast of the property [3; 61; 62; 63].

Since 1948, Roy Bros has transported liquid and dry industrial chemicals. Roy Bros currently operates a fleet of 120 tanker trucks and 25 tractors. The substances hauled include chromium, benzene, toluene, methyl ethyl ketone, and 1,1,1-trichloroethane [1, p. 2].

Prior to 1969, effluent washwater was discharged to a 1,000-gallon septic drywell located north of the building. Sludge and other residues collected from the rinsing process were disposed of in an unlined lagoon area located east of the main building. In 1969, the drywell was converted to a grease trap and the washwater was discharged into the existing lagoon area [22, p. 1].

Toward the end of 1975, Massachusetts Department of Environment Protection (MA DEP) became aware that Roy Bros was hauling hazardous wastes. Upon being notified of the hazardous waste regulations, Roy Bros applied for and obtained a 1976 license for conveyance of hazardous waste [23, p. 1].

Beginning in 1976, the effluent washwater was discharged into an unlined, infiltration lagoon area located immediately west of the building. The location of this disposal area was determined under the supervision of MA DEP [35, p. 1].

GENERAL INFORMATION (Continued)

Several inspections conducted by MA DEP in Spring 1976 revealed problems of wastewater disposal, chemical spillage, and undiked storage tanks. In July 1976, Roy Bros' hazardous waste hauling license was revoked [23, p. 1]. An administrative Order was issued requiring the cleanup and upgrading of the subsurface disposal system. MA DEP issued a Modified Order involving the construction of pretreatment facilities by December 1977 [24, p. 1].

Coastal Services, Inc., contracted by Roy Bros, removed and disposed of the contaminated contents of the easterly-located lagoons on 28 April 1977 [56].

On 23 March 1978, MA DEP approved plans for a pretreatment facility for Roy Bros [25]. Once on-line, Roy Bros was to immediately begin a sampling program and apply for sewer tie-in with the Town of Billerica [26].

MA DEP inspected Roy Bros on 30 August 1979 to examine the recently installed treatment plant. The treated effluent was being discharged to the westerly-located lagoon without proper MA DEP approval. In addition, sludge was collected in drums, pumped into Roy Bros tanker trucks, and hauled to Cannon Engineering for incineration [27, p. 1]. No documentation concerning disposal is known to exist.

On 4 January 1980, Thorestensen Laboratory (Thorestensen) personnel conducted sampling for physical parameters of the effluent wastewater. Based on the analytical results, Roy Bros was denied a permit for connection to the Billerica sewer system on 18 March 1980 [28].

On 17 November 1980, EPA identified Roy Bros through a Surface Impoundment Assessment (SIA) report, as a potential hazardous waste site. The reason cited for its identification was the presence of an unlined lagoon area, which could contribute to groundwater contamination [29].

On 6 February 1981, a MA DEP inspection revealed that all grit, skimming, and sludge from the pretreatment facility were either "stored" or disposed of on site. Three tanker trucks were on the property filled with sludge. Roy Bros combined the sludge with portland cement and dumped it on the ground. Two large piles were observed to the east of the building at the time of the inspection. Visible contamination of the ground and surface runoff which drained into the nearby Shawsheen River was evident. Numerous drums, containing rinsing residues from the truck cleaning operations, were observed on the ground surface to the east of the building. Some of the drums were reported as leaking and overflowing onto the ground [30, pp. 2-4]. Mr. Maurice Roy of Roy Bros indicated that the sludge was being taken away by Maine Coastal [33, p. 2]. No documentation concerning the disposal of sludge is known to exist.

On 13 February 1981, MA DEP collected samples of the western infiltration lagoon, the adjacent wetlands, and effluent sludge stored in a tanker on the property. The analytical results indicated elevated levels of acetone, toluene, ethyl benzene, xylenes, and methyl ethyl ketone at each sample location [31, p. 1; 32, pp. 1-5].

GENERAL INFORMATION (Continued)

Additional samples were collected by MA DEP on the property on 24 February 1981 to determine the possible environmental impacts as a result of the company's operation. Three surface water samples were collected along the Shawsheen River at the following locations: upstream of the property, at a probable point of entry located along the eastern edge of the property in the adjacent wetland, and near the intake for the Burlington Water Treatment Plant, which is located approximately 1.4 miles downstream of the property [33, p. 1]. The analytical results revealed trace concentrations of 1,1,1-trichloroethane in samples from each location [34, pp. 1-3].

In April 1981, Roy Bros was issued a permit to tie-in with the Billerica sewer system. The westerly-located infiltration lagoon was eliminated from the treatment process [35, pp.1-2]. A 25,000-gallon diesel underground storage tank (UST) was installed in the vicinity of the westerly-located lagoon in 1981. According to MA DEP, discolored soils were observed to a depth of twelve feet below grade during installation activities [75, p. 3]. No documentation exists concerning excavation and removal of soil from the vicinity of the former infiltration lagoon.

On 15 December 1981, MA DEP performed a Preliminary Assessment (PA) of the Roy Bros property for the EPA. The PA indicated that the waste from Roy Bros was in both liquid and sludge form, and had toxic, flammable, and highly volatile characteristics. Contamination to the groundwater, surface water, and soil were listed as potential hazards [45, pp. 1-4].

On 21 April 1983, a MA DEP inspection of Roy Bros revealed the following: a tanker truck being used for temporary sludge storage and one "cemented sludge" pile found along the northern edge of the property. The tanker truck was reportedly emptied twice a month by a licensed hazardous waste hauler; however, no manifest documentation was available [35, pp. 1-3].

On 23 December 1983, MA DEP inspected the wastewater treatment facility located on the Roy Bros property. Approximately 7,000 gallons of wastewater were treated daily by the treatment system. The effluent was discharged as a clear, yellow liquid to the Billerica sewer system [52].

On 21 and 22 February 1984, the Federal Highway Administration (FHA) performed a Safety Management Audit of Roy Bros. The audit indicated that Roy Bros transported chemicals for the following suppliers: Mobil, Exxon, Monsanto, Polyvinyl Chemical, George Mann, Reichhold Chemical, Dow Chemical, and Cargill. The audit revealed that manifests existed for the transportation of generated hazardous waste liquid not otherwise specified (NOS), waste solvent NOS, and waste oil NOS. The manifests indicated that the primary transporter for shipments was Suffolk Services [36, pp. 1-2].

On 22 January 1985, Thorstensen personnel sampled the discharge from the pretreatment system located on the Roy Bros property for physical water quality parameters. Analytical results indicated biochemical oxygen demand (BOD), total solids, and chrome at concentrations of 1,130 milligrams per liter (mg/L), 48 mg/L, and 22 mg/L, respectively [65].

GENERAL INFORMATION (Continued)

On 26 February 1985, MA DEP inspected the facility's truck washing and waste treatment process. Two dozen drums were observed in the two wash bays. The contents of these drums were pumped into an unregistered white, double-lined tanker kept in the front yard. Two other non-registered 5,500-gallon tankers were parked in the back yard; each about two-thirds full. Neither of these tankers were reportedly properly marked or labeled. An uncovered cemented sludge pile was also observed by MA DEP personnel in the east back yard during the 1985 inspection [37, pp. 1-2].

On 5 March 1985, samples were collected by EPA during a Resource Conservation and Recovery Act (RCRA) Industrial Survey of the property. Analysis of the samples indicated that the contents of three tankers and an open drum were considered hazardous based on ignitability. Mr. Roy stated that Roy Bros had been storing waste onsite for over two years in the tankers. EPA reviewed manifests from Roy Bros of which only 16 of the facility signed copies could be located. EPA observed no site security alarms or communication systems in the yard [38, pp. 1-11].

On 15 May 1985, MA DEP collected samples of the treated wastewater discharged from the pretreatment system for physical water quality parameters. Analytical results indicated elevated concentrations for BOD, chemical oxygen demand (COD), and total solids in the samples [69].

On 2 July 1985, a Complaint, Compliance Order, and Notice of Opportunity for Hearing was issued to Roy Bros by EPA. The Order addressed non-compliance to numerous RCRA regulations by Roy Bros and included a civil penalty against Roy Bros [46].

Between 30 April and 21 June 1986, a hydrogeologic investigation of the Roy Bros was performed by the Paulding Co. (Paulding). Five borings and five monitoring wells were installed on the Roy Bros property. Samples from each well were obtained on 9 May 1986 by Environmental Field Services, Inc. (EFS) and analyzed for priority pollutant metals, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). VOCs in the monitoring wells located in the former lagoon areas were detected at concentrations of 1 part per million (ppm). The total concentration of VOCs in the water samples from the monitoring Well Nos. 1, 2, and 3 averaged less than 0.1 ppm. The concentrations of SVOCs in the samples taken from Well Nos. 1, 3, 4, and 5 were below detection limits, and, in Well No. 2, the total concentration was 0.02 ppm [40, pp. 1-7].

Leak-testing was conducted on the two buried 1,000-gallon concrete tanks used to collect and temporarily store the washwaters from the truck-washing operations. According to Paulding, the tanks were considered leak-tight based on National Fire Protection Standards [40, pp. 4-5].

A SSI was conducted by NUS/FIT on the Roy Bros property in 1988. NUS/FIT concluded that, although a removal operation took place, the potential for direct contact still existed [1, pp. 1-2].

GENERAL INFORMATION (Continued)

On 11 September 1992, American Environmental Laboratories, Incorporated (AEL), collected groundwater samples at a series of locations on the Roy Bros property. Unfiltered groundwater samples were collected from Well Nos. 1, 2, 3, 4, and 5. These samples were tested for priority pollutant metals, VOCs, and SVOCs. Results indicated that the concentrations of metals were below detection limits. Neither VOCs nor SVOCs were detected in the samples from the wells [41].

An additional round of sampling was performed by AEL on 21 June 1993. The samples were analyzed for priority pollutant metals, VOCs, and SVOCs. Analytical results indicated the presence of elevated concentrations of bis(2-ethylhexyl)phthalate, di-n-butylphthalate, ethyl benzene, and xylenes in Well No. 5. No priority metals were detected in any of the groundwater samples from the monitoring wells [47].

In July 1993, Paulding submitted a request to the MA DEP to remove Roy Bros from the MA DEP's List of Confirmed Disposal Sites and Locations to be Investigated [39].

On 14 April 1994, Mr. Leo Roy of Roy Bros submitted a Response Action Outcome (RAO) Statement to the MA DEP [43]. In conjunction with the RAO Statement, Paulding provided a Licensed Site Professional (LSP) Evaluation Opinion Transmittal Form indicating that a observed release may have occurred at the location but the response actions were completed prior to the date of the opinion [43].

On 20 December 1994, MA DEP informed Roy Bros that an audit of several response actions undertaken on the property would be conducted. The audit was intended to ensure the response actions were conducted according to Massachusetts Contingency Plan (MCP) and other relevant laws and regulations [48].

On 13 March 1995, the results of the Roy Bros audit were submitted by MA DEP. The results identified deficiencies in the response actions conducted at Roy Bros. The audit revealed the need for further investigation due to the lack of sufficient data for the soil and nearby surface water targets [44].

Paulding collected soil samples on 18 May 1995 during the advancement of test borings by Soil Exploration Corporation. The samples were analyzed by IEA-Massachusetts, Inc. (IEA), for priority pollutant metals, VOCs, and SVOCs. Elevated levels of bis(2-ethylhexyl)phthalate were detected in a majority of the samples [21].

Groundwater samples were collected on 1 June 1995 by Geologic Field Services (GFS). The samples were analyzed for priority pollutant metals, VOCs, and SVOCs. Two additional wells, Nos. 6 and 7, were installed on the property. Elevated levels of vinyl chloride were detected in the Well No. 6 groundwater sample [20].

GENERAL INFORMATION (Continued)

START personnel conducted an on-site reconnaissance on 20 September 1995 of the Roy Bros property in Billerica, Massachusetts. START personnel were joined onsite by Messrs. Leo and Maurice Roy of Roy Bros, Mr. Bartlett Paulding of the Paulding Company, and Ms. Nancy Fitzpatrick of the MA DEP [2, p. 2]. The on-site reconnaissance of the property included paved and unpaved portions, potential source areas, and inspection of on-site monitoring wells and the existing treatment facility [2, pp. 3-13].

On 19 December 1995, START personnel conducted sampling activities at the Roy Bros property. A total of eight environmental samples were collected from sediment locations in the adjacent wetland area. START sediment samples were submitted for full organic, total metals, and cyanide analyses through the EPA Contract Laboratory Program (CLP) [2, pp. 16-23].

SOURCE EVALUATION

Description of each Source: Identify each source area by name and number, and classify each source into a source type category (see SI Table 1). Describe the dimensions of each source. Identify the hazardous substances associated with each source. Determine the containment characteristics for each source by pathway (see HRS Tables 3-2, 4-2, 6-3 and 6-9).

The wastestream at the Roy Bros property is associated with the cleaning of the tanker trucks after each load. The rinsing of the interior and exterior of the tanker trucks with water and detergent produces wash water and sludge waste. The washwater is collected in the washing bays by means of floor drains.

From 1948 to 1978, washwater and sludge waste were disposed of on the Roy Bros property using the following methods:

(1) Subsurface Disposal System (Other) - A former septic tank/drywell is located north of the building. This disposal area is believed to be in the vicinity of an existing above-ground waste storage tank and a former fuel underground storage tank. From 1948 to 1968, the washwater from truck rinsing operations was discharged to this dry well. The extent of discharge to this source is unknown. The volume of the suspected drywell was 1,000 gallons [23]. No washwater treatment before disposal is known to have occurred. This subsurface disposal area was converted to a grease pit in 1968. This source will be evaluated as a volume on Tier C.

(2) Infiltration Lagoon (Surface Impoundment) - A unlined infiltration lagoon was located east of the main building. Roy Bros began discharging sludge residue to this lagoon in 1948. In 1968, washwater was combined with the sludge for disposal into this source [23]. The lagoon was located adjacent to the wetlands that abut the eastern boundary of the property [2]. The subsurface of the former lagoon consists of fine sand and silt [58]. This disposal area was approximately 6,000 ft² [2]. During the period of disposal, no waste treatment of the washwater is known to have occurred. Prior to 1974, the extent of discharge to this source is unknown. Between 1974 and 1976, approximately 6,000 gallons of washwater per day (gpd) were discharged to this disposal area. Constituents of the treated washwater include plastisizers, resins, chromates, styrene monomers, and xylenes [30, pp. 2-3]. In April of 1977, Coastal Services, Inc., removed and disposed the contents of this lagoon area; however, no documentation of the removal exists [56]. This source will be evaluated as a wastestream based on the overall amount of washwater discharged to this source between 1974 and 1976.

A system for treatment of the washwater was installed in 1978. Operating intermittently for approximately 5 hours (hrs) per day, the system includes a 3,000-gallon vertical grit chamber, a baffled oil skimmer, and a settling basin [2; 52].

SOURCE EVALUATION (Continued)

From 1978 to 1981, treated washwater was stored in a holding tank until the treated effluent could be discharged to the following disposal location:

(3) Infiltration Lagoon (Surface Impoundment) - A former unlined infiltration lagoon is located off the southwest corner of the main building. The lagoon was approximately 1,200 ft². The subsurface of the former lagoon ranged from fine sand and silt to medium gravel [58]. This lagoon was initially installed in 1976 and received washwater and sludge waste until 1978. The extent of sludge waste discharged to this source is unknown. Between 1976 and 1981, approximately 6,000 gallons of untreated and treated washwater per day were discharged to this source [35]. Based on results of source samples collected in February of 1981, acetone and methyl ethyl ketone were detected in the lagoon [32]. In April 1981, Roy Bros was issued a permit to tie-in with the Billerica sewer system. The westerly-located infiltration lagoon was eliminated from the treatment process [35, pp. 1-2]. A 25,000-gallon diesel UST was installed in the vicinity of the westerly-located lagoon in 1981. According to MA DEP, discolored soils were observed to a depth of 12 feet below grade during installation activities [75, p.3]. No documentation exists concerning excavation and removal of soil from the vicinity of the former infiltration lagoon. Therefore, this source will be evaluated as a waste stream based on the overall amount of treated and untreated washwater waste disposed between 1976 and 1981.

Two waste streams exist in the treatment process. First, before each truck is washed, all excess chemicals are removed [2]. Known as a "heel," excess chemicals are drained from a tanker truck into a bucket [55]. From the bucket, the heels are disposed of using the following sequence:

(4) Two Dozen Drums (Drums) - A former hazardous waste storage area is located within the building. Approximately two dozen drums were reportedly observed in the vicinity of the two wash bays. The heels were emptied from buckets into the drums. The drums were located on an impervious concrete floor and were improperly marked and labeled. Some of the drums did not have lids. No secondary containment was observed [30]. The use of this storage facility was reportedly discontinued in 1985 [39]. The extent of discharge to this source is unknown. Therefore, this source will be evaluated as a volume on Tier C.

(5) Mobile AST Trucks (Tanks) - Tanker trucks served as ASTs on the property. The ASTs were utilized as bulk storage for the heels. These unregistered, double-lined tankers were periodically pumped with the contents of the drums. The volume of each AST was approximately 5,500 gallons. In 1985, one AST was located in the front yard of the property. The contents of this AST were reportedly disposed of every few months by a licensed hazardous waste hauler; however, no documentation regarding removal exists. Three other ASTs were located side by side in the northern portion of the property. These ASTs were known to have stored heels for over 2 years. No evidence exists pertaining to the removal of the heels from these ASTs. All ASTs were located off the paved area of the property; no secondary containment was observed [37].

SOURCE EVALUATION (Continued)

The extent of discharge to this source is unknown. Therefore, this source will be evaluated as a volume on Tier C.

(6) Hazardous Waste AST Truck (Tank) - A temporary storage area is located north of the main building. From 1985 to the present, a 5,500-gallon tanker was used as an AST for the temporary storage of heels [37; 55]. The AST currently is protected with a steel dike. The AST is a double-walled tank with several exterior panels rusting off revealing the interior wall of the AST. Only two sides of the AST display proper labels for hazardous waste storage. In addition, several dents in the sides of the AST are visible. The AST is raised on blocks within an uncovered steel moat. The area of the steel moat is 525 ft². Within the moat, standing water had a stained red tint. An open drainage pipe outfall lies in the northwest corner of the moat. An approximate 1-square foot area of stained soil is located outside the moat adjacent to the outfall pipe [2]. Approximately 2,000 gallons of heels were reportedly emptied from this AST by a licensed hazardous waste hauler [2]. From 1985 to the present day, approximately 55,600 gallons of heels have been disposed of through this source [64]. From 1985 to the present, manifests for the removal and disposal of this source by a licensed hazardous waste hauler exist; therefore, this source will not be evaluated.

Grit, skimming, and sludge are removed from the washwater during the treatment process. The grit, skimming, and sludge are then collected and disposed of on the property. Approximately 2,500 gallons of grit, skimming, and sludge are generated from this treatment process each month. Manifest documentation exists beginning 11 January 1985 [38]. Based on observations and sampling events performed by EPA and MA DEP, this waste was disposed of on the Roy Bros property from 1978 to 1985 using the following methods:

(7) Cemented Sludge Pile (Pile) - A former disposal location exists in the vicinity of the former eastern lagoon area. In 1980, Roy Bros attempted to combine the effluent sludge with portland cement, dump the product on the ground, and cover the pile with plastic. In 1981, two large piles of cemented sludge were observed. In 1983, only one 8- to 10-foot high pile was observed. The plastic covering over the pile was severely damaged, exposing the sludge surface. In 1985, a cemented sludge pile was again observed on the property; directly on the ground, the pile was cone-shaped and approximately 7 feet high, partially covered with a plastic sheet. Reportedly, this disposal practice was an isolated incident and was discontinued [2; 35]. No evidence exists of any cemented sludge pile presently on the property; the removal date is unknown. The area of the cemented sludge pile will be assumed to be 100 ft². This source will be evaluated on tier C as a volume of 1,050 cubic volume (ft³).

SOURCE EVALUATION (Continued)

(8) Mobile Tanker Trucks (Tanks) - Tanker trucks were used as ASTs for sludge waste. In 1981, three junked tankers were observed filled with sludge on the property. In 1985, two tankers were observed in the back of the building; each approximately two-thirds full. No secondary containment was observed. Sludge waste was reportedly stored in these tankers for a minimum of two years. One of the tankers bore a strong lacquer odor, and the other tanker had no cover on the central fill hole. Each of these tankers was improperly marked and labeled. The volume of each tanker was 5,500 gallons [37; 38]. The frequency of waste disposal into these tankers is unknown. This source will be evaluated on tier C as two tanks with an approximate volume of 11,000 gallons [64].

Additional sources on the property include the following:

(9) Eleven Drums (Drums) - A temporary drum storage area is also located within the building. The current inventory of the storage area is as follows: three 55-gallon drums of methyl ethyl ketone, two 55-gallon drums of ethyl acetate, four 55-gallon drums of sulfuric acid, and two 55-gallon drums of caustic potash. The drums are stored on wooden pallets on an impervious concrete floor under cover. Potential spills are contained by an impervious, 2-inch wide trough. In the trough, contents flow into the rinsing bays where the flow is directed through the treatment system [2]. This source is not available to any pathway and will not be evaluated.

(10) Burn Area (Contaminated Soil) - The "burn area" is located between the building and the former eastern lagoon and is approximately 5,600 ft². In this area, debris ranging from oil filters to office supplies was deposited into a trench and burned [2]. The time period for disposal to this source is unknown. This source will be evaluated on tier D as contaminated soil.

(11) Sandblasting Area (Contaminated Soil) - A 4,400-ft² area of blackened surficial soil is located south of the former eastern lagoon area. This area is reportedly the recent location for a short-term sandblasting operation. An old trailer north of the building contains bags of "Black Beauty," a sandblasting material. The constituents of this blackened soil and "Black Beauty" are unknown [2]. This source will be evaluated on tier D as contaminated soil.

(12) Fuel Underground Storage Tank (Tank) - A former 4,000-gallon UST was located on the property. This UST was originally located beneath the main building and moved to a location north of the building at an unknown date. The UST was removed in 1975; however, no documentation is known to exist [39]. This source is ineligible for evaluation based on the petroleum exclusion policy.

(13) Diesel Underground Storage Tank (Tank) - A 25,000-gallon diesel UST is located off the southwest corner of the main building [39]. This source is ineligible for evaluation based on the petroleum exclusion policy.

SOURCE EVALUATION
(Continued)

Source No.	Source Type	Pathway Availability			
		GW	SW	SE	A
1	Other	Y	Y	Y	Y
2	Surface Impoundment	Y	Y	Y	Y
3	Surface Impoundment	Y	Y	Y	Y
4	Drums	Y	Y	Y	Y
5	Tank	Y	Y	Y	Y
6	Tank	N	N	N	N
7	Pile	Y	Y	Y	Y
8	Tank	Y	Y	Y	Y
9	Drums	N	N	N	N
10	Contaminated Soil	Y	Y	Y	Y
11	Contaminated Soil	Y	Y	Y	Y
12	Tank	I	I	I	I
13	Tank	I	I	I	I

Legend: Y = available to pathway
 N = not available to pathway
 ? = availability unknown
 I = ineligible waste

SOURCE EVALUATION (Continued)

Hazardous Waste Quantity (HWQ) Calculations: SI Tables 1 and 2 (See HRS Tables 2-5, 2-6, and 5-2).

For each source, provide HWQ calculations by tier and provide assumptions. Note: HWQ calculations may be different for the soil exposure pathway.

No source has sufficient information available to evaluate on Tier A (Constituent Quantity). Sources 6 and 9 will not be used to calculate the HWQ value. Sources 12 and 13 contain fuel, a Comprehensive Environment Response Compensation, and Liability Act (CERCLA) ineligible substance, and therefore will not be used to calculate the HWQ value.

(1) Subsurface Disposal System (Other)

Tier B (Wastestream)

Insufficient information is available to evaluate the source on this tier.

Tier C (Volume)

A former drywell/septic tank is located north of the building. The volume of the suspected drywell was 1,000 gallons [23]. For multiple source sites, the volume of this source, in cubic yards (yd³), is divided by 2.5 to determine the source WQ value.

$$\begin{aligned} 1,000 \text{ gallons} &= 5 \text{ yd}^3 \\ 5 \text{ yd}^3 \div 2.5 &= 2 \end{aligned}$$

Tier D (Area)

This source will not be evaluated on this tier.

$$\text{Source WQ} = 2$$

(2) Infiltration Lagoon (Surface Impoundment)

Tier B (Wastestream)

An unlined lagoon area was located east of the main building. Prior to 1974, the extent of discharge to this source is unknown. Between 1974 and 1976, approximately 3.12-million gallons of washwater were discharged to this disposal area [30, pp. 2-3]. For multiple source sites, the amount of the wastestream, in pounds (lbs), is divided by 5,000 to determine the source WQ value.

$$\begin{aligned} 3.12\text{E}+06 \text{ gallons} &= 31.2\text{E}+06 \text{ lbs} \\ 31.2\text{E}+06 \text{ lbs} \div 5,000 &= 6,240 \end{aligned}$$

SOURCE EVALUATION (Continued)

Tier C (Volume)

This source will not be evaluated on this tier.

Tier D (Area)

This source will not be evaluated on this tier.

$$\text{Source WQ} = 6,240$$

(3) Infiltration Lagoon (Surface Impoundment)

Tier B (Wastestream)

An unlined lagoon area was located southwest of the main building. This lagoon was initially installed in 1976 and received washwater and sludge waste until 1978. The extent of sludge waste discharged to this source area is unknown. Between 1976 and 1981, approximately 7.8-million gallons of untreated and treated washwater were discharged to this source [35]. For multiple source sites, the amount of the wastestream, in lbs, is divided by 5,000 to determine the source WQ value.

$$7.8\text{E}+06 \text{ gallons} = 78\text{E}+06 \text{ lbs}$$

$$78\text{E}+06 \text{ lbs} \div 5,000 = 15,600$$

Tier C (Volume)

This source will not be evaluated on this tier.

Tier D (Area)

This source will not be evaluated on this tier.

$$\text{Source WQ} = 15,600$$

SOURCE EVALUATION (Continued)

(4) Two Dozen Drums (Drums)

Tier B (Wastestream)

Insufficient information is available to evaluate the source on this tier.

Tier C (Volume)

Approximately two dozen drums were located within the building for the storage of heels. For multiple source sites, the number of drums is divided by 10 to determine the Source WQ value.

$$24 \div 10 = 2.4$$

Tier D (Area)

This source will not be evaluated on this tier.

$$\text{Source WQ} = 2.4$$

(5) Mobile AST Trucks (Tanks)

Tier B (Wastestream)

Insufficient information is available to evaluate the source on this tier.

Tier C (Volume)

Four tanker trucks were observed on the property as above-ground storage tanks. The volume of each AST was approximately 5,500 gallons. For multiple source sites, the volume of the source, in yd^3 , is divided by 2.5 to determine the Source WQ value.

$$22,000 \text{ gallons} = 1,100 \text{ yd}^3$$

$$1,100 \text{ yd}^3 \div 2.5 = 440$$

SOURCE EVALUATION (Continued)

Tier D (Area)

This source will not be evaluated on this tier.

$$\text{Source WQ} = 440$$

(7) Cemented Sludge Pile (Pile)

Tier B (Wastestream)

Insufficient information is available to evaluate the source on this tier.

Tier C (Volume)

An uncovered cemented sludge pile was located in the area of the former eastern infiltration lagoon. This pile was approximately 8- to 10-feet high, and its area will be assumed to be 100 ft². For multiple source sites, the volume of a pile, in ft³, is divided by 67.5 to determine the Source WQ value.

$$1,050 \div 67.5 = 15.5$$

Tier D (Area)

This source will not be evaluated on this tier.

$$\text{Source WQ} = 15.15$$

(8) Mobile AST Trucks (Tanks)

Tier B (Wastestream)

Insufficient information is available to evaluate the source on this tier.

Tier C (Volume)

Two 5,500-gallon tanker trucks were used as ASTs for sludge waste. These ASTs stored an unknown amount of sludge for two years [37; 38]. For multiple source sites, the volume of a tank, in gallons, is divided by 500 to determine the Source WQ value.

$$11,000 \div 500 = 22$$

Tier D (Area)

The "Tanks" source type cannot be evaluated on tier D.

$$\text{Source WQ} = 22$$

SOURCE EVALUATION (Continued)

(10) Burn Area (Contaminated Soil)

Tier B (Wastestream)

Insufficient information is available to evaluate the source on this tier.

Tier C (Volume)

Insufficient information is available to evaluate the source on this tier.

Tier D (Area)

The Burn Area is located between the building and the former eastern infiltration lagoon and is approximately 5,600 ft² [2]. For multiple source sites, the area of contaminated soil, in ft², is divided by 34,000 to determine the source WQ value.

$$5,600 \text{ ft}^2 \div 34,000 = 0.16$$

$$\text{Source WQ} = 0.16$$

(11) Sandblasting Area (Contaminated Soil)

Tier B (Wastestream)

Insufficient information is available to evaluate the source on this tier.

Tier C (Volume)

Insufficient information is available to evaluate the source on this tier.

Tier D (Area)

The sandblasting area is located south of the former eastern infiltration lagoon and is approximately 4,400 ft² [2]. For multiple source sites, the area of contaminated soil, in ft², is divided by 34,000 to determine the source WQ value.

$$4,400 \text{ ft}^2 \div 34,000 = 0.13$$

$$\text{Source WQ} = 0.13$$

SOURCE EVALUATION (Concluded)

Based on WQ values from sources 1, 2, 3, 4, 5, 7, 8, 10, and 11, the site WQ for the Groundwater Pathway is $2 + 6,240 + 15,600 + 2.4 + 440 + 15.15 + 22 + 0.16 + 0.13 = 22,321.84$. From SI Table 2, a HWQ Score of 10,000 is assigned for the pathway.

GW HWQ = 10,000

Based on WQ values from sources 1, 2, 3, 4, 5, 7, 8, 10, and 11, the site WQ for the Surface Water Pathway is $2 + 6,240 + 15,600 + 2.4 + 440 + 15.15 + 22 + 0.16 + 0.13 = 22,321.84$. From SI Table 2, a HWQ Score of 10,000 is assigned for the pathway.

SW HWQ = 10,000

Based on WQ values from sources 1, 2, 3, 4, 5, 7, 8, 10, and 11, the site WQ for the Soil Exposure Pathway is $2 + 6,240 + 15,600 + 2.4 + 440 + 15.15 + 22 + 0.16 + 0.13 = 22,321.84$. From SI Table 2, a HWQ Score of 10,000 is assigned for the pathway.

SE HWQ = 10,000

Based on WQ values from sources 1, 2, 3, 4, 5, 7, 8, 10, and 11, the site WQ for the Air Pathway is $2 + 6,240 + 15,600 + 2.4 + 440 + 15.15 + 22 + 0.16 + 0.13 = 22,321.84$. From SI Table 2, a HWQ Score of 10,000 is assigned for the pathway.

AIR HWQ = 10,000

SI TABLE 1:

HAZARDOUS WASTE QUANTITY (HWQ) SCORES FOR SINGLE SOURCE SITES AND FORMULAS FOR MULTIPLE SOURCE SITES

Tier	Source Type	Single Source Sites (assigned HWQ scores)				Multiple Source Sites
		HWQ = 10	HWQ = 100	HWQ = 10,000	HWQ = 1,000,000	Divisors for Assigning Source WQ Values
A Hazardous Constituent Quantity	N/A	HWQ = 1 if Hazardous Constituent Quantity data are complete HWQ = 10 if Hazardous Constituent Quantity data are not complete	> 100 to 10,000 lbs	> 10,000 to 1 million lbs	> 1 million lbs	lbs ÷ 1
B Hazardous Wastestream Quantity	N/A	≤ 500,000 lbs	> 500,000 to 50 million lbs	> 50 million to 5 billion lbs	> 5 billion lbs	lbs ÷ 5,000
C Volume	Landfill	≤ 6.75 million ft ³ ≤ 250,000 yd ³	> 6.75 million to 675 million ft ³ > 250,000 to 25 million yd ³	> 675 million to 67.5 billion ft ³ > 25 million to 2.5 billion yd ³	> 67.5 billion ft ³ > 2.5 billion yd ³	ft ³ ÷ 67,500 yd ³ ÷ 2,500
	Surface impoundment	≤ 6,750 ft ³ ≤ 250 yd ³	> 6,750 to 675,000 ft ³ > 250 to 25,000 yd ³	> 675,000 to 67.5 million ft ³ > 25,000 to 2.5 million yd ³	> 67.5 million ft ³ > 2.5 million yd ³	ft ³ ÷ 67.5 yd ³ ÷ 2.5
	Drums	≤ 1,000 drums	> 1,000 to 100,000 drums	> 100,000 to 10 million drums	> 10 million drums	drums ÷ 10
	Tanks and non-drum containers	≤ 50,000 gallons	> 50,000 to 5 million gallons	> 5 million to 500 million gallons	> 500 million gals.	gallons ÷ 500
	Contaminated soil	≤ 6.75 million ft ³ ≤ 250,000 yd ³	> 6.75 million to 675 million ft ³	> 675 million to 67.5 billion ft ³ > 25 million to 2.5 billion yd ³	> 67.5 billion ft ³ > 2.5 billion yd ³	ft ³ ÷ 67,500 yd ³ ÷ 2,500
	Pile	≤ 6,750 ft ³ ≤ 250 yd ³	> 6,750 to 675,000 ft ³ > 250 to 25,000 yd ³	> 675,000 to 67.5 million ft ³ > 25,000 to 2.5 million yd ³	> 67.5 million ft ³ > 2.5 million yd ³	ft ³ ÷ 67.5 yd ³ ÷ 2.5
	Other	≤ 6,750 ft ³ ≤ 250 yd ³	> 6,750 to 675,000 ft ³ > 250 to 25,000 yd ³ > 6,750 to 675,000 ft ³ > 250 to 25,000 yd ³	> 675,000 to 67.5 million ft ³ > 25,000 to 2.5 million yd ³	> 67.5 million ft ³ > 2.5 million yd ³	ft ³ ÷ 67.5 yd ³ ÷ 2.5

SI TABLE 1:

HAZARDOUS WASTE QUANTITY (HWQ) SCORES FOR SINGLE SOURCE SITES AND FORMULAS FOR MULTIPLE SOURCE SITES

Tier	Source Type	Single Source Sites (assigned HWQ scores)				Multiple Source Sites
		HWQ = 10	HWQ = 100	HWQ = 10,000	HWQ = 10,000,000	Divisors for Assigning Source WQ Values
D Area	Landfill	$\leq 340,000 \text{ ft}^2$ $\leq 7.8 \text{ acres}$	$> 340,000 \text{ to } 34 \text{ million ft}^2$ $> 7.8 \text{ to } 780 \text{ acres}$	$> 34 \text{ million to } 3.4 \text{ bil. ft}^2$ $> 780 \text{ to } 78,000 \text{ acres}$	$> 3.4 \text{ billion ft}^2$ $> 78,000 \text{ acres}$	$\text{ft}^2 \div 3,400$ $\text{acres} \div 0.078$
	Surface Impoundment	$\leq 1,300 \text{ ft}^2$ $\leq 0.029 \text{ acres}$	$> 1,300 \text{ to } 130,000 \text{ ft}^2$ $> 0.029 \text{ to } 2.9 \text{ acres}$	$> 130,000 \text{ to } 13 \text{ million ft}^2$ $> 2.9 \text{ to } 290 \text{ acres}$	$> 13 \text{ million ft}^2$ $> 290 \text{ acres}$	$\text{ft}^2 \div 13$ $\text{acres} \div 0.00029$
	Contaminated Soil	$\leq 3.4 \text{ million ft}^2$ $\leq 78 \text{ acres}$	$> 3.4 \text{ million to } 340 \text{ million ft}^2$ $> 78 \text{ to } 7,800 \text{ acres}$	$> 340 \text{ million to } 34 \text{ bil. ft}^2$ $> 7,800 \text{ to } 780,000 \text{ acres}$	$> 34 \text{ billion ft}^2$ $> 780,000 \text{ acres}$	$\text{ft}^2 \div 34,000$ $\text{acres} \div 0.78$
	Pile	$\leq 1,300 \text{ ft}^2$ $\leq 0.029 \text{ acres}$	$> 1,300 \text{ to } 130,000 \text{ ft}^2$ $> 0.029 \text{ to } 2.9 \text{ acres}$	$> 130,000 \text{ to } 13 \text{ million ft}^2$ $> 2.9 \text{ to } 290 \text{ acres}$	$> 13 \text{ million ft}^2$ $> 290 \text{ acres}$	$\text{ft}^2 \div 13$ $\text{acres} \div 0.00029$
	Land treatment	$\leq 27,000 \text{ ft}^2$ $\leq 0.62 \text{ acres}$	$> 27,000 \text{ to } 2.7 \text{ million ft}^2$ $> 0.62 \text{ to } 62 \text{ acres}$	$> 2.7 \text{ mil. to } 270 \text{ million ft}^2$ $> 62 \text{ to } 6,200 \text{ acres}$	$> 270 \text{ million ft}^2$ $> 6,200 \text{ acres}$	$\text{ft}^2 \div 270$ $\text{acres} \div 0.0062$

1 ton = 2,000 lbs = 1 yd³ = 4 drums = 200 gallons

SI TABLE 2: HWQ SCORES FOR MULTIPLE SOURCE SITES

Site WQ Total	HWQ Score
0	0
1 ^a to 100	1 ^b
> 100 to 10,000	100
> 10,000 to 1,000,000	10,000
> 1,000,000	1,000,000

^aIf the HWQ total is between 0 and 1, round it to 1.^bIf the hazardous constituent quantity data are not complete, assign the score of 10.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET

Sources:

1. Other

2. Surface Impoundment

3. Surface Impoundment

4. Drums

5. Tanks

6. Tanks

7. Pile

8. Tanks

9. Drums

10. Contaminated Soil

11. Contaminated Soil

12. Tank

13. Tank

Source	Hazardous Substance	Toxicity	GROUND WATER PATHWAY		SURFACE WATER PATHWAY							
			GW Mobility (HRS Table 3-8)	Tox. × Mobility Value (HRS Table 3-9)	Pers. (HRS Tables 4-10 and 4-11)	Tox. × Pers. Value (HRS Table 4-12)	Bioacc. Pot. (HRS Table 4-15)	OVERLAND/FLOOD MIGRATION				
								Tox. × Pers. × Bioacc. Value (HRS Table 4-16)	Ecotox. (HRS Table 4-19)	Ecotox. × Pers. (HRS Table 4-20)	Eco. Bioacc. Pot. (HRS Table 4-20)	Ecotox. × Pers. × Eco. Bioacc. Value (HRS Table 4-21)
2,3,8	Acetone	10	1.0	10.0	8.4	4.0	0.5	2.0	100	40	0.5	20
10	Anthracene	10	0.01	0.1	1.0	10	5,000	50,000	10,000	10,000	50,000	5.0E+08
2,10	Benzene	100	1.0	100.0	0.4	40.0	5,000	2.0E+05	100	40.0	500.0	20,000
10	Benz(a)anthracene	1,000	0.01	10.0	1.0	1,000	50,000	5.0E+07	10,000	10,000	50,000	5.0E+08
10	Benzo(b)fluoranthene	100	0.0001	0.01	1.0	100.0	50,000	5.0E+06	NL	--	50,000	--
2	Butylbenzene, n-	NL	NL	--	NL	--	NL	--	NL	--	NL	--
2	Butylbenzene, s-	NL	NL	--	NL	--	NL	--	NL	--	NL	--
2	Butylbenzene, t-	NL	NL	--	NL	--	NL	--	NL	--	NL	--
1,2,3	Bis(2-ethylhexyl)phthalate	100	0.0001	0.01	1.0	100.0	50,000	5.0E+06	1,000	1,000.0	50,000	5.0E+07

BCF

SCDM Version: JUL95

References: 20; 21; 32; 34; 47

Notes: All hazardous substances detected above reference criteria in environmental samples collected from the Roy Bros Haulers property are included in SI Table 3. Groundwater mobility values were chosen from non-karst terrain values in liquid from SCDM. Persistence and bioaccumulation values were chosen based on the freshwater downstream pathway; trans-1,2-dichloroethylene was used to evaluate 1,2-dichloroethene.

NL denotes substance not listed in SCDM.

-- denotes unable to calculate due to lack of data in SCDM.

denotes hazardous substance detected during pathway sampling of the Roy Bros Haulers property.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET

Sources:

1. Other

2. Surface Impoundment

3. Surface Impoundment

4. Drums

5. Tanks

6. Tanks

7. Pile

8. Tanks

9. Drums

10. Contaminated Soil

11. Contaminated Soil

12. Tank

13. Tank

Source	Hazardous Substance	Toxicity	GROUND WATER PATHWAY		SURFACE WATER PATHWAY							
			GW Mobility (HRS Table 3-8)	Tox. × Mobility Value (HRS Table 3-9)	Pers. (HRS Tables 4-10 and 4-11)	Tox. × Pers. Value (HRS Table 4-12)	Bioacc. Pot. (HRS Table 4-15)	OVERLAND/FLOOD MIGRATION				
								Tox. × Pers. × Bioacc. Value (HRS Table 4-16)	Ecotox. (HRS Table 4-19)	Ecotox. × Pers (HRS Table 4-20)	Eco. Bioacc. Pot. (HRS Table 4-20)	Ecotox. × Pers. × Eco. Bioacc. Value (HRS Table 4-21)
#	Carbon disulfide	1,000	1.0	1,000	0.4	400.0	500	2.0E+05	100	40.0	500.0	20,000
2	Chlorobenzene	100	1.0	100.0	0.0007	0.07	50.0	35	1000	0.7	50.0	35.0
#	Chloroethane	1	1.0	10.0	0.0007	0.0007	5.0	0.0035	NL	--	5.0	--
#	Chloroform	100	1.0	100.0	0.4	40.0	5.0	200.0	10	4.0	5.0	20.0
#	Chrysene	10	0.01	0.1	1.0	10	500.0	5,000	1,000	1,000	5,000	5.0E+06
#	Di-n-butylphthalate	NL	NL	--	NL	--	NL	--	NL	--	NL	--
2	Dichlorobenzene, 1,2-	10	1.0	1.0	0.4	4.0	50.0	200.0	100	40.0	50.0	2,000
10	Dichlorobenzene, 1,4-	10	1.0	10.0	0.4	4.0	50.0	200.0	100	40.0	50.0	2,000
3	Dichloroethylene, 1,2-trans-	100	1.0	100.0	0.4	40.0	50.0	2,000	1	0.4	50.0	20.0

BCF

SCDM Version: JUL95

References: 20; 21; 32; 34; 47

Notes: All hazardous substances detected above reference criteria in environmental samples collected from the Roy Bros Haulers property are included in SI Table 3. Groundwater mobility values were chosen from non-karst terrain values in liquid from SCDM. Persistence and bioaccumulation values were chosen based on the freshwater downstream pathway; trans-1,2-dichloroethylene was used to evaluate 1,2-dichloroethene. NL denotes substance not listed in SCDM. -- denotes unable to calculate due to lack of data in SCDM. # denotes hazardous substance detected during pathway sampling of the Roy Bros Haulers property.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET (Continued)

Sources:
Other
2. Surface Impoundment

3. Surface Impoundment
4. Drums

5. Tanks
6. Tanks

7. Pile
8. Tanks

9. Drums
10. Contaminated Soil

11. Contaminated Soil
12. Tank

13. Tank

Source	Hazardous Substance	Toxicity	GROUND WATER PATHWAY		SURFACE WATER PATHWAY							
			GW Mobility (HRS Table 3-8)	Tox. × Mobility Value (HRS Table 3-9)	Pers. (HRS Tables 4-10 and 4-11)	Tox. × Pers. Value (HRS Table 4-12)	Bioacc. Pot. (HRS Table 4-15)	OVERLAND/FLOOD MIGRATION				
								Tox. × Pers. × Bioacc. Value (HRS Table 4-16)	Ecotox. (HRS Table 4-19)	Ecotox. × Pers (HRS Table 4-20)	Eco. Bioacc. Pot. (HRS Table 4-20)	Ecotox. × Pers. × Eco. Bioacc. Value (HRS Table 4-21)
1,2,3	Ethylbenzene	10	1.0	10.0	0.4	0.4	50.0	20.0	100	40.00	50.0	2,000.0
2	Ethyl Chloride	1	1.0	1.0	0.0007	0.0007	5.0	0.0035	NL	--	5.0	--
2	Fluoranthene	100	0.01	1.0	1.0	100.0	5,000	5.0E+05	10,000	10,000	5,000.0	5.0E+07
#	Fluorene	100	0.01	1.0	1.0	100	5,000	5.0E+05	1,000	1,000	5,000	5.0E+06
#	2-hexanone	1	1.0	1.0	0.4	0.4	5.0	2.0	1.0	0.4	5.0	2.0
2	Isopropylbenzene	NL	NL	--	NL	--	NL	--	NL	--	NL	--
2	Isopropyltoluene, p-	NL	NL	--	NL	--	NL	--	NL	--	NL	--

BCF

SCDM Version: JUL95

References: 20; 21; 32; 34; 47

Notes: All hazardous substances detected above reference criteria in environmental samples collected from the Roy Bros Haulers property are included in SI Table 3. Groundwater mobility values were chosen from non-karst terrain values in liquid from SCDM. Persistence and bioaccumulation values were chosen based on the freshwater downstream pathway.
NL denotes substance not listed in SCDM.
-- denotes unable to calculate due to lack of data in SCDM.
denotes hazardous substance detected during pathway sampling of Roy Bros Haulers property.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET (Continued)

Sources:

1. Other

2. Surface Impoundment

3. Surface Impoundment

4. Drums

5. Tanks

6. Tanks

7. Pile

8. Tanks

9. Drums

10. Contaminated Soil

11. Contaminated Soil

12. Tank

13. Tank

Source	Hazardous Substance	Toxicity	GROUND WATER PATHWAY				SURFACE WATER PATHWAY					
			GW Mobility (HRS Table 3-8)	Tox. × Mobility Value (HRS Table 3-9)	Pers. (HRS Tables 4-10 and 4-11)	Tox. × Pers. Value (HRS Table 4-12)	Bioacc. Pot. (HRS Table 4-15)	OVERLAND/FLOOD MIGRATION				
								Tox. × Pers. × Bioacc. Value (HRS Table 4-16)	Ecotox. (HRS Table 4-19)	Ecotox. × Pers. (HRS Table 4-20)	Eco. Bioacc. Pot. (HRS Table 4-20)	Ecotox. × Pers. × Eco. Bioacc. Value (HRS 4-21)
5,6,7,8	Methylene chloride	10	1.0	10.0	0.4	4.0	5.0	20.0	1	0.4	5.0	2.0
2,3,8	Methyl ethyl ketone	10	1.0	10.0	0.4	4.0	0.5	2.0	1	0.4	0.5	0.2
2	Methyl isobutyl ketone	10	1.0	10.0	0.4	4.0	5.0	20.0	1	0.4	5.0	2.0
#	2-methylnaphthalene	NL	0.01	--	0.4	--	5,000	--	1,000	400.0	5,000.0	2.0E+06
#	4-methylphenol	NL	NL	--	NL	--	NL	--	NL	--	NL	--
#	Napthalene	100	1.0	100	0.4	40	500.0	20,000.0	1,000	400.0	500.0	2.0E+05
#	Pentachlorophenol	100	1.0	100	0.4	4	50.0	50,000.0	100	100	5,000.0	5.0E+05
2	Phenathrene	NL	0.01	--	1.0	--	50.0	--	10,000	10,000	5,000.0	5.0E+07
#	Phenol	1	1.0	1.0	1.0	1.0	5.0	5.0	10,000	10,000	5.0	50,000.0
							BCF					

SCDM Version: JUL95

References: 20; 21; 32; 34; 47

Notes: All hazardous substances detected above reference criteria in environmental samples collected from the Roy Bros Haulers property are included in SI Table 3. Groundwater mobility values were chosen from non-karst terrain values in liquid from SCDM. Persistence and bioaccumulation values were chosen based on the freshwater downstream pathway.

NL denotes substance not listed in SCDM.

-- denotes unable to calculate due to lack of data in SCDM.

denotes hazardous substance detected during pathway sampling of Roy Bros Haulers property.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET (Continued)

Sources:

1. Other

2. Surface Impoundment

3. Surface Impoundment

4. Drums

5. Tanks

6. Tanks

7. Pile

8. Tanks

9. Drums

10. Contaminated Soil

11. Contaminated Soil

12. Tank

13. Tank

Source	Hazardous Substance	Toxicity	GROUND WATER PATHWAY				SURFACE WATER PATHWAY					
			GW Mobility (HRS Table 3-8)	Tox. × Mobility Value (HRS Table 3-9)	Pers. (HRS Tables 4-10 and 4-11)	Tox. × Pers. Value (HRS Table 4-12)	Bioacc. Pot. (HRS Table 4-15)	OVERLAND/FLOOD MIGRATION				
								Tox. × Pers. × Bioacc. Value (HRS Table 4-16)	Ecotox. (HRS Table 4-19)	Ecotox. × Pers. (HRS Table 4-20)	Eco. Bioacc. Pot. (HRS Table 4-20)	Ecotox. × Pers. × Eco. Bioacc. Value (HRS Table 4-21)
2	Pyrene	100	0.01	1.0	1.0	100.0	50.0	5,000.0	10,000	10,000	50.0	5.0E+05
2	Styrene	10	1.0	10.0	0.4	4.0	50.0	200.0	100	40.0	50.0	2,000.0
3,8	Toluene	10	1.0	10.0	0.4	4.0	50.0	200.0	100	40.0	50.0	2,000.0
1,2	Trimethylbenzene, 1,2,4-	NL	NL	--	NL	--	NL	--	NL	--	NL	--
2	Trimethylbenzene, 1,3,5-	NL	NL	--	NL	--	NL	--	NL	--	NL	--
3,8	Trichloroethane, 1,1,1-	1	1.0	1.0	0.4	0.4	5.0	2.0	10	4.0	5.0	20.0
#	Trichloroethylene	10	1.0	10	0.4	4.0	50.0	200.0	100	40.0	50.0	2,000.0
3	Tetrachloroethene	100	1.0	100	0.4	40.0	50.0	2,000	100	40.0	50.0	2,000.0
2	Tetrahydrofuran	1	1.0	1.0	0.4	0.4	0.5	0.2000	1	0.4	0.5	0.2
1	Vinyl chloride	10,000	1.0	10,000	0.0007	7	5.0	35	NL	--	5.0	--
1,2,3,8	Xylenes	10	1.0	10.0	0.4	4.0	50.0	200.0	100	40.0	50.0	2,000.0

BCF

SCDM Version: JUL95

References: 20; 21; 32; 34; 47

Notes: All hazardous substances detected above reference criteria in environmental samples collected from the Roy Bros Haulers property are included in SI Table 3. Groundwater mobility values were chosen from non-karst terrain values in liquid from SCDM. Persistence and bioaccumulation values were chosen based on the freshwater downstream pathway. P-xylene was used in order to evaluate xylene.

NL denotes substance not listed in SCDM.

-- denotes unable to calculate due to lack of data in SCDM.

denotes hazardous substance detected during pathway sampling of Roy Bros Haulers property.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET (Continued)

Sources:

1. Other

2. Surface Impoundment

3. Surface Impoundment

4. Drums

5. Tanks

6. Tanks

7. Pile

8. Tanks

9. Drums

10. Contaminated Soil

11. Contaminated Soil

12. Tank

13. Tank

Source	Hazardous Substance	Toxicity	GROUND WATER PATHWAY		SURFACE WATER PATHWAY							
			GW Mobility (HRS Table 3-8)	Tox. × Mobility Value (HRS Table 3-9)	Pers. (HRS Tables 4-10 and 4-11)	Tox. × Pers. Value (HRS Table 4-12)	Bioacc. Pot. (HRS Table 4-15)	OVERLAND/FLOOD MIGRATION				
								Tox. × Pers. × Bioacc. Value (HRS Table 4-16)	Ecotox. (HRS Table 4-19)	Ecotox. × Pers (HRS Table 4-20)	Eco. Bioacc. Pot. (HRS Table 4-20)	Ecotox. × Pers. × Eco. Bioacc. Value (HRS 4-21)
#	4,4'-DDD	100	0.0001	0.01	1.0	100	50,000	5.0E+06	10,000	10,000	50,000	5.0E+08
#	Aroclor 1254	10,000	0.01	100	1.0	10,000	50,000	5.0E+08	10,000	10,000	50,000	5.0E+08
3	Arsenic	10,000	0.01	100	1.0	10,000	5.0	50,000	100	100	500	50,000
#	Beryllium	10,000	0.01	100	1.0	10,000	50.0	5.0E+05	NL	--	50.0	--
2	Cadmium	10,000	0.01	100	1.0	10,000	5,000	5.0E+07	1,000	1,000	5,000	5.0E+06
2	Chromium	10,000	0.01	100	1.0	10,000	5.0	50,000	10,000	10,000	5.0	50,000
3	Copper	NL	0.01	--	1.0	--	50,000	--	100	100	50,000	5.0E+06
10	Lead	10,000	0.01	100	1.0	10,000	50.0	5.0E+05	1,000	1,000	5,000	5.0E+06
#	Mercury	10,000	0.01	100	1.0	10,000	50,000	5.0E+08	10,000	10,000	50,000	5.0E+08
10	Nickel	100	0.01	1	1.0	100	0.5	50	10	10	500	5,000
#	Selenium	100	0.01	1	1.0	100	5,000	5.0E+05	1,000	1,000	5,000	5.0E+06
10	Zinc	10	0.01	0.1	1.0	10	500	5,000	10	10	500	5,000

BCF

SCDM Version: JUL95

References: 20; 21; 32; 34; 47

Notes: All hazardous substances detected above reference criteria in environmental samples collected from the Roy Bros Haulers property are included in SI Table 3. Groundwater mobility values were chosen from non-karst terrain values in liquid from SCDM. Persistence and bioaccumulation values were chosen based on the freshwater downstream pathway.

NL denotes substance not listed in SCDM.

-- denotes unable to calculate due to lack of data in SCDM.

denotes hazardous substance detected during pathway sampling of the Roy Bros Haulers property.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET (Continued)

Sources:

1. Other

2. Surface Impoundment

3. Surface Impoundment

4. Drums

5. Tanks

6. Tanks

7. Pile

8. Tanks

9. Drums

10. Contaminated Soil

11. Contaminated Soil

12. Tank

13. Tank

Source	Hazardous Substance	Toxicity	SURFACE WATER PATHWAY				AIR PATHWAY		
			GROUND WATER TO SURFACE WATER				Gaseous/ Particulate (HRS Table 6-13) (indicate G or P)	Mobility (HRS Table 6-11, 6-12)	Tox. × Mob. Value (HRS Table 6-13)
			Tox. × Mob. × Pers. Value (HRS Table 4-26)	Tox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-28)	Ecotox. × Mob. × Pers. Value (HRS Table 4-29)	Ecotox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-30)			
2,3,8	Acetone	10	4.0	2.0	40.0	20.0	G	1.0	10.0
10	Anthracene	10	0.1	50.0	100.0	5,000	G/P	0.002	0.02
2	Benzene	100	40.0	2.0E+05	40.0	2.0E+05	G	1.0	100.0
10	Benz(a)anthracene	1,000	10	5.0E+05	100.0	5.0E+06	G/P	0.002	2.0
10	Benzo(b)fluoranthene	100	0.01	500.0	--	--	G/P	0.0002	0.02
2	Butylbenzene, n-	NL	--	--	--	--	NL	NL	--
2	Butylbenzene, s-	NL	--	--	--	--	NL	NL	--
2	Butylbenzene, t-	NL	--	--	--	--	NL	NL	--
1,2,3	Bis(2-ethylhexyl)phthalate	100	0.01	500.0	0.10	5,000	G,P	0.002	0.2

SCDM Version: JUL95

References: 20; 21; 32; 34; 47

Notes: All hazardous substances detected above reference criteria in environmental samples collected from the Roy Bros Haulers property are included in SI Table 3. Groundwater mobility values were chosen from non-karst terrain values in liquid from SCDM. Persistence and bioaccumulation values were chosen based on the freshwater downstream pathway; trans-1,2-dichloroethene was used to evaluate 1,2-dichloroethene.

NL denotes substance not listed in SCDM.

-- denotes unable to calculate due to lack of data in SCDM.

denotes hazardous substance detected during pathway sampling of Roy Bros Haulers property.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET (Continued)

Sources:

1. Other

2. Surface Impoundment

3. Surface Impoundment

4. Drums

5. Tanks

6. Tanks

7. Pile

8. Tanks

9. Drums

10. Contaminated Soil

11. Contaminated Soil

12. Tank

13. Tank

Source	Hazardous Substance	Toxicity	SURFACE WATER PATHWAY				AIR PATHWAY		
			GROUND WATER TO SURFACE WATER				Gaseous/ Particulate (HRS Table 6-13) (indicate G or P)	Mobility (HRS Table 6-11, 6-12)	Tox. × Mob. Value (HRS Table 6-13)
			Tox. × Mob. × Pers. Value (HRS Table 4-26)	Tox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-28)	Ecotox. × Mob. × Pers. Value (HRS Table 4-29)	Ecotox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-30)			
#	Carbon disulfide	1,900	400.0	2.0E+05	40.0	20,000.0	G	1.0	1,000.0
2	Chlorobenzene	100	0.07	3.5	0.7	35.0	G	1.0	100.0
#	Chloroform	100	40.0	200.0	4.0	20.0	G	1.0	100.0
#	Chloroethane	1	0.0007	0.0035	--	--	G	1.0	1.0
#	Chrysene	10	0.1	50.0	10	5,000	G/P	0.0002	0.002
#	Di-n-butylphthalate	NL	--	--	--	--	NL	NL	--
2	Dichlorobenzene, 1,2-	10	4.0	200.0	40.0	2,000.0	G	1.0	10.0
10	Dichlorobenzene, 1,4-	10	4.0	200.0	40.0	2,000.0	G	1.0	10.0
3	Dichloroethylene, 1,2-trans-	100	40.00	2000.0	0.40	20.0	G	1.0	100.0

SCDM Version: JUL95

References: 20; 21; 32; 34; 47

Notes: All hazardous substances detected above reference criteria in environmental samples collected from the Roy Bros Haulers property are included in SI Table 3. Groundwater mobility values were chosen from non-karst terrain values in liquid from SCDM. Persistence and bioaccumulation values were chosen based on the freshwater downstream pathway; trans-1,2-dichloroethylene was used to evaluate 1,2-dichloroethene.

NL denotes substance not listed in SCDM.

-- denotes unable to calculate due to lack of data in SCDM.

denotes hazardous substance detected during pathway sampling of Roy Bros Haulers property.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET (Continued)

Sources:

1. Other

2. Surface Impoundment

3. Surface Impoundment

4. Drums

5. Tanks

6. Tanks

7. Pile

8. Tanks

9. Drums

10. Contaminated Soil

11. Contaminated Soil

12. Tank

13. Tank

Source	Hazardous Substance	Toxicity	SURFACE WATER PATHWAY				AIR PATHWAY		
			GROUND WATER TO SURFACE WATER				Gaseous/ Particulate (HRS Table 6-13) (indicate G or P)	Mobility (HRS Table 6-11, 6-12)	Tox. × Mob. Value (HRS Table 6-13)
			Tox. × Mob. × Pers. Value (HRS Table 4-26)	Tox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-28)	Ecotox. × Mob. × Pers. Value (HRS Table 4-29)	Ecotox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-30)			
1,2,3	Ethylbenzene	10	4.6	200.0	40.0	2,000.0	G	1.0	10.0
2	Ethyl Chloride	1	0.0007	0.0025	--	--	G	1.0	1.0
2	Fluoranthene	100	1.0	5,000	100	50,000	G,P	0.002	0.2
#	Fluorene	100	1.0	5,000	100	5.0E+05	G,P	0.02	2.0
#	2-hexanone	1	0.4	2.0	0.4	2.0	G	1.0	1.0
2	Isopropylbenzene	NL	--	--	--	--	NL	NL	--
2	Isopropyltoluene, p-	NL	--	--	--	--	NL	NL	--

SCDM Version: JUL95

References: 20; 21; 32; 34; 47

Notes: All hazardous substances detected above reference criteria in environmental samples collected from the Roy Bros Haulers property are included in SI Table 3. Groundwater mobility values were chosen from non-karst terrain values in liquid from SCDM. Persistence and bioaccumulation values were chosen based on the freshwater downstream pathway; trans 1,2-dichloroethylene was used to evaluate 1,2-dichloroethene.

NL denotes substance not listed in SCDM.

-- denotes unable to calculate due to lack of data in SCDM.

denotes hazardous substance detected during pathway sampling of Roy Bros Haulers property.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET (Continued)

Sources:

1. Other

2. Surface Impoundment

3. Surface Impoundment

4. Drums

5. Tanks

6. Tanks

7. Pile

8. Tanks

9. Drums

10. Contaminated Soil

11. Contaminated Soil

12. Tank

13. Tank

Source	Hazardous Substance	Toxicity	SURFACE WATER PATHWAY				AIR PATHWAY		
			GROUND WATER TO SURFACE WATER				Gaseous/ Particulate (HRS Table 6-13) (indicate G or P)	Mobility (HRS Table 6-11, 6-12)	Tox. × Mob. Value (HRS Table 6-13)
			Tox. × Mob. × Pers. Value (HRS Table 4-26)	Tox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-28)	Ecotox. × Mob. × Pers. Value (HRS Table 4-29)	Ecotox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-30)			
5,6,7,8	Methylene chloride	10	4.0	20.0	4.0	20.0	G	1.0	10.0
2,3,8	Methyl ethyl ketone	10	4.0	2.0	0.4	0.2	G	1.0	10.0
2	Methyl isobutyl ketone	10	4.0	20.0	0.4	2.0	G	1.0	10.0
#	2-methylnapthalene	NL	--	--	4.0	20,000	G/P	0.2	0
#	4-methylphenol	NL	--	--	--	--	NL	NL	--
#	Napthalene	100	40	20,000	400.0	2.0E+05	G/P	0.2	20.0
#	Pentachlorophenol	100	100	50,000	100.0	50,000	G/P	0.02	2.0
2	Phenathrene	NL	--	--	100.0	5,000	G/P	0.02	--
#	Phenol	1	1.0	5.0	10,000	50,000	G	1.0	1.0

SCDM Version: JUL95

References: 20; 21; 32; 34; 47

Notes: All hazardous substances detected above reference criteria in environmental samples collected from the Roy Bros Haulers property are included in SI Table 3. Groundwater mobility values were chosen from non-karst terrain values in liquid from SCDM. Persistence and bioaccumulation values were chosen based on the freshwater downstream pathway; trans-1,2-dichloroethene was used to evaluate 1,2-dichloroethene.

NL denotes substance not listed in SCDM.

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denotes hazardous substance detected during pathway sampling of Roy Bros Haulers property.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET (Continued)

Sources:

1. Other

2. Surface Impoundment

3. Surface Impoundment

4. Drums

5. Tanks

6. Tanks

7. Pile

8. Tanks

9. Drums

10. Contaminated Soil

11. Contaminated Soil

12. Tank

13. Tank

Source	Hazardous Substance	Toxicity	SURFACE WATER PATHWAY				AIR PATHWAY		
			GROUND WATER TO SURFACE WATER				Gaseous/ Particulate (HRS Table 6-13) (indicate G or P)	Mobility (HRS Table 6-11, 6-12)	Tox. × Mob. Value (HRS Table 6-13)
			Tox. × Mob. × Pers. Value (HRS Table 4-26)	Tox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-28)	Ecotox. × Mob. × Pers. Value (HRS Table 4-29)	Ecotox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-30)			
2	Pyrene	100	1.0	50.0	100	5,000	G,P	0.002	0.2
2	Styrene	10	4.0	200.0	40.0	2,000	G	1.0	10.0
3,8	Toluene	10	4.0	200.0	40.0	2,000	G	1.0	10.0
2	Trimethylbenzene, 1,2,4-	NL	--	--	--	--	NL	NL	--
2	Trimethylbenzene, 1,3,5-	NL	--	--	--	--	NL	NL	--
3,8	Trichloroethane, 1,1,1-	1	0.4	2.0	4.0	20.0	G	1.0	1.0
#	Trichloroethylene	10	4.0	200	40	2,000	G	1.0	10
3	Tetrachloroethene	100	40.0	2,000	40.0	2,000	G	1.0	100.0
2	Tetrahydrofuran	1	0.4	0.2	0.4	0.2	G	1.0	1.0
1	Vinyl Chloride	10,000	7.0	35.0	--	--	G	1.0	10,000
1,2,3,8	Xylenes	10	4.0	200.0	40.0	2,000	G	1.0	10.0

SCDM Version: JUL95

References: 20; 21; 32; 34; 47

Notes: All hazardous substances detected above reference criteria in environmental samples collected from the Roy Bros Haulers property are included in SI Table 3. Groundwater mobility values were chosen from non-karst terrain values in liquid from SCDM. Persistence and bioaccumulation values were chosen based on the freshwater downstream pathway; P-xylene was used to evaluate xylene.

NL denotes substance not listed in SCDM.

-- denotes unable to calculate due to lack of data in SCDM.

denotes hazardous substance detected during pathway sampling of Roy Bros Haulers property.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET (Concluded)

Sources:

1. Other

2. Surface Impoundment

3. Surface Impoundment

4. Drums

5. Tanks

6. Tanks

7. Pile

8. Tanks

9. Drums

10. Contaminated Soil

11. Contaminated Soil

12. Tank

13. Tank

Source	Hazardous Substance	Toxicity	SURFACE WATER PATHWAY				AIR PATHWAY		
			GROUND WATER TO SURFACE WATER				Gaseous/ Particulate (HRS Table 6-13) (indicate G or P)	Mobility (HRS Table 6-11, 6-12)	Tox. × Mob. Value (HRS Table 6-13)
			Tox. × Mob. × Pers. Value (HRS Table 4-26)	Tox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-28)	Ecotox. × Mob. × Pers. Value (HRS Table 4-29)	Ecotox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-30)			
#	4,4'-DDD	100	0.01	500.0	0.1	5,000	G,P	0.0020	0.2
#	Aroclor 1254	10,000	100	5.0E+06	100.0	5.0E+06	G	0.020	200.0
3	Arsenic	10,000	100	500.0	1.0	500.0	P	NL	--
#	Beryllium	10,000	100	50,000	--	--	P	NL	--
2	Cadmium	10,000	100	5.0E+05	10.0	50,000	P	NL	--
3	Chromium	10,000	100	500.0	100.0	5.0E+06	P	NL	--
3	Copper	NL	--	--	1.0	50,000	P	NL	--
10	Lead	10,000	100	5,000	10.0	500.0	P	NL	--
#	Mercury	10,000	100	5.0E+06	100.0	5.0E+06	G,P	0.2	2,000
10	Nickel	100	1.0	0.5	0.1	0.05	P	NL	--
#	Selenium	100	1.0	5,000	10	50,000	P	NL	--
10	Zinc	10	0.1	50	0.1	50	P	NL	--

SCDM Version: JUL95

References: 20; 21; 32; 34; 47

Notes: All hazardous substances detected above reference criteria in environmental samples collected from the Roy Bros Haulers property are included in SI Table 3. Groundwater mobility values were chosen from non-karst terrain values in liquid from SCDM. Persistence and bioaccumulation values were chosen based on the freshwater downstream pathway.

NL denotes substance not listed in SCDM.

-- denotes unable to calculate due to lack of data in SCDM.

denotes hazardous substance detected during pathway sampling of the Roy Bros Haulers property.

GROUNDWATER PATHWAY

Pathway Description and Scoring Notes: Describe the Groundwater Migration Pathway. Include the names and brief descriptions of the aquifers underlying the site, the depth to groundwater, the locations of the nearest private and public drinking water supplies and the aquifers from which they draw, and the population relying upon ground water drawn from within four miles of the site for their drinking water supplies.

Briefly discuss any sampling events relative to the Groundwater Pathway; provide dates of sampling events and a summary of the analytical results and whether an observed release and/or actual contamination targets were documented.

Indicate any assumptions you have made in scoring the Groundwater Pathway for this site, or any key factors which influence your scoring rationale.

The soils in the area of the Roy Bros Haulers property are classified as Udorthents, Scarboro, and Saco units. The Udorthents unit occurs in the south and southwest areas of the property and consists of sandy material which has been excavated due to construction. The Scarboro unit is located in the central and northwest sections of the property and is comprised of loamy sand over stratified sand and gravel at 3 to 16 inches of depth. The Saco unit is located in the east and northeast portions of the property and is characterized as mucky silty loam and consists of very poorly drained soils on floodplains. This unit has rapid permeability and its slope varies from 1 to 3% [18, pp. 24-26].

Beneath the overburden, the underlying bedrock includes sedimentary and volcanic rock consisting of Boxford members. This formation is characterized as thin-bedded to massive amphibolite and minor biotite gneiss [64]. No bedrock formation mapped within 4-radial miles of the property exhibits karst characteristics.

Groundwater flow direction in the area of the Roy Bros property is estimated to be toward the east. The localized groundwater flow across the property was obtained from groundwater elevations collected by Paulding in July of 1986. The depth to the groundwater on the property is approximately 7 feet [40, p. 4]. Annual precipitation in the Billerica area is 44.77 inches per year [77].

All or part of the following Massachusetts cities and towns are located within 4-radial miles of Roy Bros Haulers: Bedford, Billerica, Burlington, Carlisle, Lexington, Tewksbury, and Wilmington [3; 61; 62; 63]. The nearest public drinking water wells to the property, the Terrance Hall Road Well Nos. 1 and 2, are located (b) (9) of the property; the wells are blended to service the Town of Burlington [15]. The persons who rely on private groundwater supplies within 4-radial miles of the property were estimated using equal distribution of U.S. Census CENTRACTS data identifying population, households, and private water wells for "Block Groups" which lie wholly or in part within individual radial distance rings measured from potential sources on the property [17]. According to the Billerica Board of Health, no private wells are located within 1-radial mile of the property [17; 51]. Public and private groundwater supplies located within 4-radial miles of the property serve an estimated 19,194 people [9; 10; 11; 12; 13; 14; 15; 16; 17]. The following table summarizes the public groundwater supply sources within 4-radial miles of the Roy Bros property.

Public Groundwater Supply Sources Within 4-Radial Miles of Roy Bros Haulers

Distance/ Direction from Site	Source Name (Town Served)	Location of Source ^a	Estimated Population Served	Source Type ^b
(b) (9)	Terrance Hall Road No.1 (Burlington)	Burlington	1,422	overburden, gravel pack
	Terrance Hall Road No.2 (Burlington)	Burlington	852	overburden, gravel pack
	Middlesex Turnpike No.3 (Burlington)	Burlington	852	overburden, gravel pack
	Middlesex Turnpike No.4 (Burlington)	Burlington	852	overburden, gravel pack
	Middlesex Turnpike No.5 (Burlington)	Burlington	711	overburden, gravel pack
	Shawsheen Well No.2 (Bedford)	Bedford	787	overburden, gravel pack
	Shawsheen Well No.4 (Bedford)	Bedford	1,384	overburden, gravel pack
	Shawsheen Well No.5 (Bedford)	Bedford	829	overburden, gravel pack
	Butters Row Well No.1 (Wilmington)	Wilmington	2,678	overburden, gravel pack
	Butters Row Well No.2 (Wilmington)	Wilmington	2,083	overburden, gravel pack
	Chestnut Street Well No.1 (Wilmington)	Wilmington	2,529	overburden, gravel pack
	Chestnut Street Well No.1a (Wilmington)	Wilmington	2,529	overburden, gravel pack

[3; 9; 10; 11; 12; 13; 14; 15; 16; 61; 62; 63]

GROUNDWATER PATHWAY (Continued)

The following table summarizes the estimated drinking water populations served by groundwater sources within 4-radial miles of the Roy Bros property.

**Estimated Drinking Water Populations Served by Groundwater Sources
Within 4-Radial Miles of Roy Bros Haulers**

Radial Distance From Roy Bros Haulers (miles)	Estimated Population Served by Private Wells	Estimated Population Served by Public Wells	Total Estimated Population Served by Groundwater Sources Within the Ring
0.00 < 0.25	0	0	0
0.25 < 0.50	0	0	0
0.50 < 1.0	0	0	0
1.0 < 2.0	324	0	324
2.0 < 3.0	503	5,476	5,979
3.0 < 4.0	859	12,032	12,891
TOTAL	1,686	17,508	19,194

[9; 10; 11; 12; 13; 14; 15; 16; 17]

The Billerica Water Department provides drinking water to a majority of the residents of Billerica. The Water Department draws its supply solely through a surface water intake along the Concord River [14]. The intake accounts for 90% of the total annual water supply. A pair of overburden groundwater wells, Bowler Well Nos. 1 and 2, exist, but have been inactive for several years [14].

The Burlington Water Department supplies the residents of Burlington with drinking water. The supply is provided from a surface water intake, a reservoir, and a series of well fields. The surface water intake is located on the Shawsheen River, 1.37 miles downstream of the Roy Bros property [3; 61; 16]. From the intake, the water is piped into Mill Pond. The Mill Pond is a 513-million gallon reservoir which services 80% of the town [16]. Three overburden groundwater wells, known as Middlesex Turnpike well Nos. 3, 4, and 5, are located (b) (9) of the property. Based on their individual pumping rates, these wells are blended together to serve a total of 2,274 residents. Two additional overburden groundwater wells, known as Terrace Hall Well Nos. 1 and 2, are located (b) (9) of the property. Based on their individual pumping rates, these wells are also blended together to service 2,274 residents in Burlington [15].

GROUNDWATER PATHWAY (Continued)

The Massachusetts Water Resource Authority (MWRA) supplies water to the residents of Lexington. The supply is provided from reservoirs which are not located downstream of the Roy Bros property [13]. The MWRA system provides drinking water to 100% of the residents in Lexington.

Two public water supplies provide drinking water to most of the residents of Bedford. The Town of Bedford obtains 76% of its drinking water from the Town of Lexington. Bedford Water Department currently utilizes one 10-inch connection to the MWRA system via the Lexington Water Department. The residents of Bedford are also served by a wellfield located (b) (9) of the Roy Bros property along the Shawsheen River. Based on their individual pumping rates, the three overburden groundwater wells, known as Shawsheen Well Nos. 2, 4, and 5, are blended together to service 3,000 residents of Bedford [15]. Nine additional groundwater wells are located in the Town of Bedford, but have been declared inactive due to groundwater contamination from local industry [12].

The Wilmington Water Department supplies water to the residents of Wilmington via seven active overburden groundwater wells, four of which lie within 4-radial miles of the Roy Bros property [11]. A pair of wells, known as the Butters Row well Nos. 1 and 2, are located (b) (9) of the property. Based on their individual flow rates, these wells are blended to service 4,761 residents. An additional pair of wells, known as Chestnut Hill Well Nos. 1 and (b) (9) of the property. Based on their individual flow rates, these wells are blended to supply 5,058 residents with drinking water [15]. One overburden groundwater well, known as the Shawsheen Avenue Well, is maintained as an emergency well and has not been utilized in the past year. An additional overburden groundwater well, known as Aldrich Road Well, has been inactive for several years [11]. No evidence could be located related to the closure of this well.

The Town of Tewksbury is supplied with drinking water from the Tewksbury Water Department. The Water Department provides 98% of the residents with water through a surface water intake located on the Merrimack River [9]. The Water Department maintains six emergency overburden groundwater wells within 4-radial miles of the property. However, these wells have not been utilized in several years [10].

Between 9 May 1986 and 1 June 1995, four rounds of groundwater sampling occurred at Roy Bros to determine the quality of groundwater and the extent to which the groundwater beneath the property had been impacted. During each event, the collected samples were analyzed for VOCs, SVOCs, and priority pollutant metals [20; 40; 41; 47].

On 8 May 1986, monitoring wells were installed at five locations on the Roy Bros property. Wells Nos. 1, 2, and 3 were located along the edge of the wetlands and along the downgradient, eastern edge of the property. Well No. 4 was placed in the vicinity of the former eastern infiltration lagoon. Well No. 5 was located in the location of the former western infiltration lagoon. The borings were advanced by means of a hollow stem auger to

GROUNDWATER PATHWAY (Continued)

a maximum depth of 27 feet. The wells were installed by Guild Drilling Co., Inc. [58]. Each of the monitoring wells was constructed of Schedule 40 PVC with an inner diameter of two inches. The lower portions of each well consist of slotted PVC which extends from the bottom of the well to a foot above the groundwater table [40, pp.2-4].

On 13 May 1986, EFS personnel collected groundwater samples from Well Nos. 1, 2, 3, 4, and 5. All samples were analyzed for VOCs and SVOCs using EPA Methods 624 and 625 [40].

The results of the EFS sampling indicated the presence of 10 VOCs in the groundwater. Each VOC was detected at a concentration three times the respective sample quantitation limit. Among the VOCs detected, only benzene, detected in MW-01, was observed at a concentration above its maximum contaminant level (MCL) of 5 parts per billion (ppb).

In September of 1992, AEL personnel collected groundwater samples from Well Nos. 1, 2, 3, 4, and 5. All samples were unfiltered and analyzed for priority pollutant metals, VOCs, and acid extractable compounds using EPA Methods 200.7, 624, and 625, respectively. Analytical results indicated that metals, VOCs, and SVOCs were below the respective detection limits [41].

On 21 June 1993, AEL performed an additional round of groundwater sampling on the Roy Bros property. Monitoring Well Nos. 1, 2, 3, 4, and 5 were again sampled for priority pollutant metals, VOCs, and SVOCs using EPA Method 200.7, 624, and 625, respectively. The results of the AEL sampling indicated the presence of ethylbenzene and xylene in the groundwater at elevated levels in the vicinity of the former westerly-located infiltration lagoon. Bis(2-ethylhexyl)phthalate was detected above its respective MCL [47].

According to MA DEP, the method detection limit (MDL) for polychlorinated biphenyls (PCBs) reported in the AEL June 1993 groundwater analysis using EPA Method 625 was 100 ppb. Since the MCL for PCBs is 0.5 ppb, the MDL was not sufficiently sensitive to identify if PCBs were present at levels which could impact the groundwater [77, p. 9].

An additional round of groundwater sampling was performed by AEL personnel on 11 November 1993. Monitoring Well Nos. 1, 2, 3, 4, and 5 were again sampled for priority pollutant metals, VOCs, and SVOCs using EPA Method 200.7, 624, and 625, respectively. Results detected no elevated levels of metals, VOCs, or SVOCs among the samples [78].

Monitoring well installation and groundwater sampling were performed on 1 June 1995 by GFS personnel. Monitoring Well No. 6 was installed north of the building in the vicinity of the former drywell and UST location, and monitoring Well No. 7 was installed in the vicinity of the former burn area downgradient and east of Well No. 6. Groundwater samples were collected from all on-site monitoring wells and were analyzed for priority pollutant metals, VOCs, and SVOCs. QA/QC consisted of the collection of a trip blank [20]. The collection of a reference sample was not discussed.

GROUNDWATER PATHWAY (Continued)

Analytical results of the GFS sampling indicated the presence of eight compounds at concentrations three times the respective practical quantitation limit (PQL). Among the compounds detected, benzene, ethylbenzene, methylene chloride, and vinyl chloride were detected at concentrations above their respective MCL [20; 81].

SI TABLE 4: GROUNDWATER OBSERVED RELEASE SUBSTANCES (BY AQUIFER)

Note: Mobility equals 1 for all observed release substances.

Sample ID	Hazardous Substance	Substance Concentration	Bckgrd. ID.	Bckgrd. Conc.	Tox. × Mob. = Tox.	References
MW-2	Fluoranthene	5.8 ppb	--	--	100	47
	Pentachlorophenol	20 ppb	--	--	100	40
MW-3	Tetrahydrofuran	120 ppb	--	--	1	40
MW-4	Acetone	47 ppb	--	--	10	40
	Chloroethane	42 ppb	--	--	1	40
	Methyl ethyl ketone	620 ppb	--	--	10	40
	Methyl isobutyl ketone	680 ppb	--	--	10	40
MW-5	Carbon disulfide	47 ppb	--	--	1,000	20
	Styrene	45 ppb	--	--	10	40
	Toluene	190 ppb	--	--	10	40
	Bis(2-ethylhexyl)phthalate	67.4 ppb	--	--	100	47
	1,2-trans-dichloroethylene	240 ppb	--	--	100	40
	Di-n-butylethylene	28.1 ppb	--	--	NL	47
	Ethylbenzene	1,600 ppb	--	--	10	20
	Fluorene	7.2 ppb	--	--	100	47
	2-methylnaphthalene	19 ppb	--	--	NL	20
	Naphthalene	13.6 ppb	--	--	100	47
MW-6	1,2-dichloroethene	470 ppb	--	--	NL	20
	Methylene chloride	210 ppb	--	--	10	20
	Xylene	150 ppb	--	--	10	20
	Vinyl chloride	210 ppb	--	--	10,000	20
	1,2,4-trimethylbenzene	72 ppb	--	--	NL	20
MW-7	Benzene	310 ppb	--	--	100	20
	Chlorobenzene	65 ppb	--	--	100	20
	4-methylphenol	14 ppb	--	--	NL	20
	Phenol	17 ppb	--	--	1	20
Highest Value					10,000	

Notes: Between 9 May 1986 and 1 June 1995, four rounds of groundwater sampling were performed on the Roy Bros property. The collected samples were analyzed for VOCs, SVOCs, and priority pollutant metals. No priority pollutant metals were observed above detectable limits [20; 40; 41; 47].

SI TABLE 5: GROUNDWATER ACTUAL CONTAMINATION TARGETS

Notes: Convert all results and SCDM values to ppb or $\mu\text{g/L}$.

If sum of percents calculated for I or J index is $\geq 100\%$, consider the well a Level I target; if sum of I or J index is $< 100\%$, consider the well a Level II target.

Well ID: 1

Level 1:

Level II:Population Served:References:

[illegible]

SCDM Version: JUL95

Notes: There are no drinking water targets within 1-radial mile of the Roy Bros property [51].

GROUNDWATER PATHWAY WORKSHEET

LIKELIHOOD OF RELEASE

	Score	Data Type	Refs
1. OBSERVED RELEASE: If sampling data or direct observation support a release to the aquifer, assign a score of 550. Record observed release substances on SI Table 4.	550		20
2. POTENTIAL TO RELEASE: Depth to aquifer: <u>1</u> feet. If sampling data do not support a release to the aquifer, and the site is in karst terrain or the depth to aquifer is 70 feet or less, assign a score of 500; otherwise, assign a score of 340. Optionally, evaluate potential to release according to HRS Section 3.1.2.			
LR = 550			

TARGETS

	Score	Data Type	Refs
Are any wells part of a blended system? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If yes, attach a page to show apportionment calculations.	-	+	15
3. ACTUAL CONTAMINATION TARGETS: If analytical evidence indicates that any target drinking water well for the aquifer has been exposed to a hazardous substance from the site, evaluate the factor score for the number of people served (SI Table 5). Level I: $\frac{0}{0}$ people $\times 10 = \frac{0}{0}$ Level II: $\frac{0}{0}$ people $\times 1 = \frac{0}{0}$ Total = 0	0		
4. POTENTIAL CONTAMINATION TARGETS: Determine the number of people served by drinking water wells for the aquifer or overlying aquifers that are not exposed to a hazardous substance from the site; record the population for each distance category in SI Table 6a or 6b. Sum the population values and multiply by 0.1.	207.8	+	3; 9-17; 61
5. NEAREST WELL: Assign a score of 50 for any Level I Actual Contamination Targets for the aquifer or overlying aquifer. Assign a score of 45 if there are Level II targets but no Level I targets. If no Actual Contamination Targets exist, assign the Nearest Well Score from SI Table 6a or 6b. If no drinking water wells exist within 4 miles, assign 0.	5	+	3; 9-17; 61
6. WELLHEAD PROTECTION AREA (WHPA): If any source lies within or above a WHPA for the aquifer, or if a ground water observed release has occurred within a WHPA, assign a score of 20; assign 5 if neither condition applies but a WHPA is within 4 miles; otherwise assign 0.	20	+	8
7. RESOURCES: Assign a score of 5 if one or more ground water resource applies; assign 0 if none applies. <ul style="list-style-type: none"> • Irrigation (5-acre minimum) of commercial food crops or commercial forage crops • Watering of commercial livestock • Ingredient in commercial food preparation • Supply for commercial aquaculture • Supply for a major or designated water recreation area, excluding drinking water use 	5	+	
Sum of Targets T = 237.8			

Notes:

**SI TABLE 6 (FROM HRS TABLE 3-12): VALUES FOR POTENTIAL CONTAMINATION GROUNDWATER
TARGET POPULATIONS**

SI Table 6a: Other Than Karst Aquifers

Distance From Site	Pop.	Nearest Well (choose highest)	POPULATION SERVED BY WELLS WITHIN DISTANCE CATEGORY												Pop. Value	Ref.
			1 to 10	11 to 30	31 to 100	101 to 300	301 to 1000	1001 to 3000	3001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,000 to 3,000,000		
0 to 1/4 mile	0	20	4	17	53	164	522	1,633	5,214	16,325	52,137	163,246	521,360	1,632,455	0	9-17
> 1/4 to 1/2 mile	0	18	2	11	33	102	324	1,013	3,235	10,122	32,325	101,213	323,243	1,012,122	0	9-17
> 1/2 to 1 mile	0	9	1	5	17	52	167	523	1,660	5,224	16,684	52,239	166,835	522,385	0	9-17
> 1 to 2 miles	324	5	0.7	3	10	30	94	294	939	2,939	9,385	29,384	93,845	293,842	94	9-17
> 2 to 3 miles	5,979	3	0.5	2	7	21	68	212	678	2,122	6,778	21,222	67,777	212,219	678	9-17
> 3 to 4 miles	12,891	2	0.3	1	4	13	42	131	417	1,306	4,171	13,060	41,709	130,596	1,306	9-17
Nearest Well =		5													Sum =	
															2,078	

Notes: According to Billerica Health Department, no private wells are known to exist within 1-radial mile of the Roy Bros property [31].

**SI TABLE 6 (FROM HRS TABLE 3-12): VALUES FOR POTENTIAL CONTAMINATION GROUNDWATER
TARGET POPULATIONS (Continued)**

SI Table 6b: Karst Aquifers

Distance From Site	Pop.	Nearest Well (choose highest)	POPULATION SERVED BY WELLS WITHIN DISTANCE CATEGORY												Pop. Value	Ref.
			1 to 10	11 to 30	31 to 100	101 to 300	301 to 1000	1001 to 3000	3001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,001 to 3,000,000		
0 to 1/4 mile		20	4	17	53	164	522	1,635	5,214	16,325	52,137	163,246	521,360	1,632,455		
>1/4 to 1/2 mile		20	2	11	33	102	324	1,013	3,233	10,122	32,325	101,219	323,243	1,012,122		
>1/2 to 1 mile		20	2	9	26	82	261	817	2,607	8,163	26,068	81,623	260,680	816,227		
>1 to 2 miles		20	2	9	26	82	261	817	2,607	8,163	26,068	81,623	260,680	816,227		
>2 to 3 miles		20	2	9	26	82	261	817	2,607	8,163	26,068	81,623	260,680	816,227		
>3 to 4 miles		20	2	9	26	82	261	817	2,607	8,163	26,068	81,623	260,680	816,227		
Nearest Well =															Sum =	

Notes:

GROUNDWATER PATHWAY WORKSHEET (concluded)

WASTE CHARACTERISTICS

	Score	Data Type	Does Not Apply																																	
8. If any Actual Contamination Targets exist for the aquifer or overlying aquifers, assign the calculated hazardous waste quantity score or a score of 100, whichever is greater; if no Actual Contamination Targets exist, assign the hazardous waste quantity score calculated for sources available to migrate to ground water.	10,000	+																																		
9. Assign the highest ground water toxicity x mobility value from SI Table 3 or 4. Substance(s): <u>Vinyl chloride</u> <u>PCBs</u> <u>Arsenic</u> Value: <u>10,000</u> <u>10,000</u> <u>10,000</u> From Table: <u>Table 4</u> <u>Table 3</u> <u>Table 3</u>	10,000	+																																		
10. Multiply the ground water toxicity/mobility and hazardous waste quantity scores. Assign the Waste Characteristics score from the table below: (from HRS Table 2-7)	1.0E+08																																			
<table border="1"> <thead> <tr> <th>Product</th> <th>WC Score</th> <th>*</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td></td></tr> <tr><td>>0 to <10</td><td>1</td><td></td></tr> <tr><td>≥10 to <100</td><td>2</td><td></td></tr> <tr><td>≥100 to <1,000</td><td>3</td><td></td></tr> <tr><td>≥1,000 to <10,000</td><td>6</td><td></td></tr> <tr><td>≥10,000 to <1E+05</td><td>10</td><td></td></tr> <tr><td>≥1E+05 to <1E+06</td><td>18</td><td></td></tr> <tr><td>≥1E+06 to <1E+07</td><td>32</td><td></td></tr> <tr><td>≥1E+07 to <1E+08</td><td>56</td><td></td></tr> <tr><td>≥1E+08 or greater</td><td>100</td><td>✓</td></tr> </tbody> </table>				Product	WC Score	*	0	0		>0 to <10	1		≥10 to <100	2		≥100 to <1,000	3		≥1,000 to <10,000	6		≥10,000 to <1E+05	10		≥1E+05 to <1E+06	18		≥1E+06 to <1E+07	32		≥1E+07 to <1E+08	56		≥1E+08 or greater	100	✓
Product	WC Score	*																																		
0	0																																			
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≥10,000 to <1E+05	10																																			
≥1E+05 to <1E+06	18																																			
≥1E+06 to <1E+07	32																																			
≥1E+07 to <1E+08	56																																			
≥1E+08 or greater	100	✓																																		
*check (✓) the WC score calculated for the pathway																																				
WC =	100																																			

Multiply LR by T and by WC. Divide the product by 82,500 to obtain the ground water pathway score for each aquifer. Select the highest aquifer score. If the pathway score is greater than 100, assign 100.

Groundwater PATHWAY CALCULATION: $\frac{LE \times T \times WC}{82,500}$

Notes: $\frac{550 \times 237.8 \times 100}{82,500} = 158.53$

= 100

(Maximum of 100)

SURFACE WATER PATHWAY

Pathway Description and Scoring Notes: Describe the Surface Water Migration Pathway. Identify the nearest source area with non-zero containment for the Surface Water Pathway and the location of the PPE. Include the length of the overland segment. Describe the in-water segment up to the target distance limit noting the stream flow characteristics of each reach and the locations of drinking water intakes, fisheries and sensitive environments along the 15-mile pathway.

Briefly discuss any sampling events relative to the Surface Water Pathway; provide dates of sampling events and a summary of the analytical results and whether an observed release and/or actual contamination targets were documented.

Indicate any assumptions you have made in scoring the Surface Water Pathway for this site, or any factors which influenced your scoring rationale.

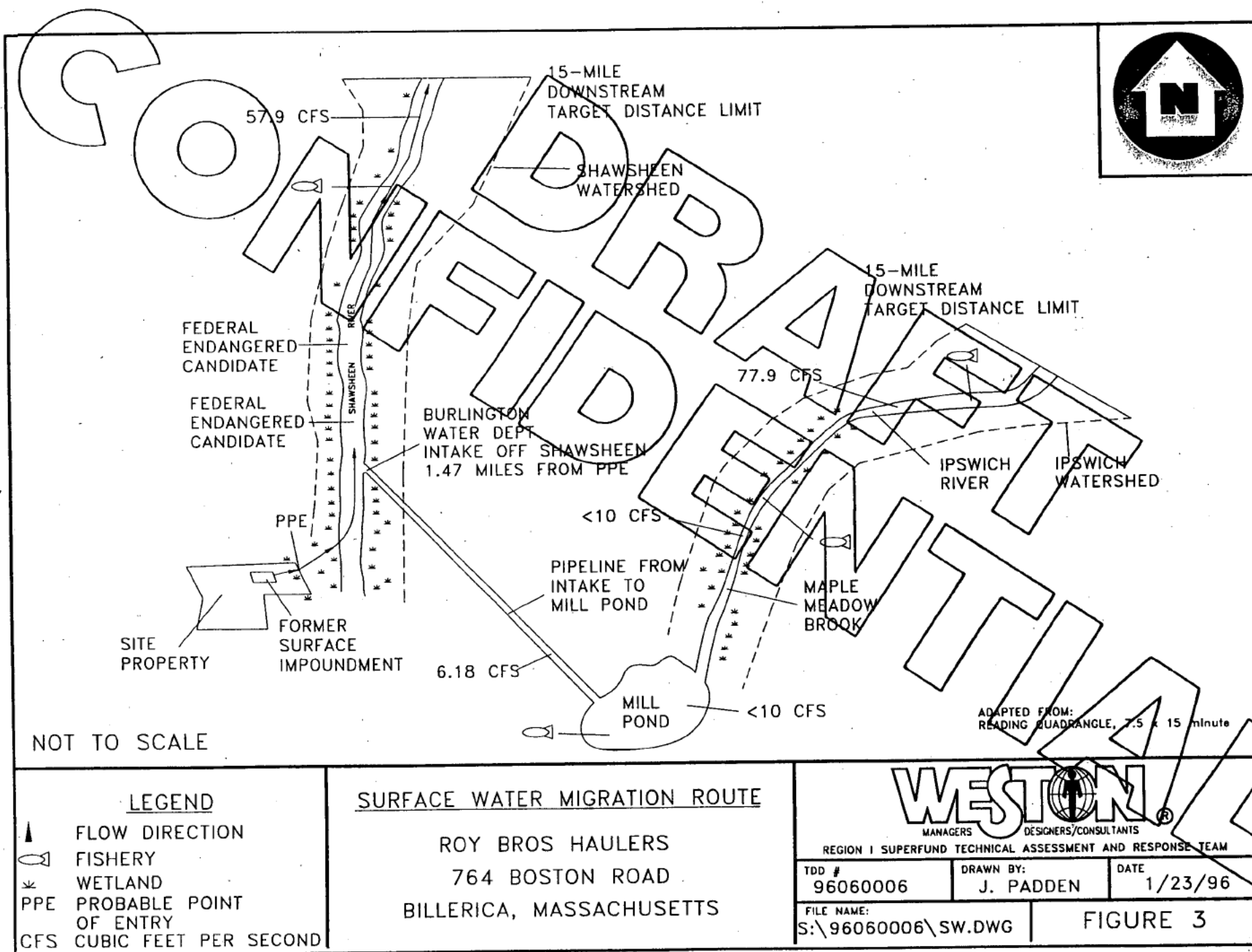
Note: If a site has more than one watershed or has both overland/flood and ground water to surface water migration potential, document each scenario and use the higher scoring watershed/migration route to calculate the surface water migration pathway score. Provide a summary of the scores for all other watershed/migration routes.

The property is located adjacent to the Shawsheen River watershed, which is approximately 675 feet east of the former eastern lagoon area. All sources to the east of the building lie within the 100-year floodplain. In addition, a majority of the property lies within the 500-year floodplain [4].

The surface water runoff from the various source areas flows east to the abutting wetland area and into the Shawsheen River. START personnel observed sparse vegetation and blackened soil that extended from the paved area west of the building to the wetland area. The eastern portion of the property extends approximately 50 feet into the wetland [2, pp. 2-14].

The 15-mile downstream surface water pathway begins at the probable point of entry (PPE), located approximately 240 feet east of the northeast corner of the building at the edge of the wetland [3; 61; 62; 63]. At the PPE, the 15-mile surface water pathway extends 510 feet northeast through the wetland area to the Shawsheen River (Figure 3).

Two watersheds exist along the 15-mile downstream surface water pathway. One 15-mile downstream target distance limit is located on the Shawsheen River, approximately 2 miles upstream from its confluence with the Merrimack River. Over the 15-mile downstream distance, the mean annual flow of the Shawsheen River is 57.9 cubic feet per second (cfs) [6, p. 45].



SURFACE WATER PATHWAY (Continued)

The following table summarizes the water bodies along the 15-mile downstream pathway from the Roy Bros property.

Water Bodies Along the 15-Mile Downstream Pathway

Surface Water Body	Descriptor ^a	Length of Reach	Flow Characteristics (cfs) ^b	Length of Wetlands
Shawsheen River	Moderate Stream	15 miles	10-100	2.2 miles
Mill Pond	Minimal Stream	1.6 miles	< 10	NA *
Maple Meadow Brook	Minimal Stream	3.67 miles	< 10	NA *
Ipswich River	Moderate Stream	6.6 miles	10-100	NA *

^a Minimal stream < 10 cfs. Small to moderate stream 10-100 cfs. Moderate to large stream > 100-1,000 cfs. Large stream to river 1,000-10,000 cfs. Large river > 10,000-100,000 cfs. Very large river > 100,000 cfs. Coastal tidal waters (flow not applicable). Shallow ocean zone or Great Lake (flow not applicable). Moderate depth ocean zone or Great Lake (flow not applicable). Deep ocean zone or Great Lake (flow not applicable). Three-mile mixing zone in quiet flowing river 10 cfs or greater.

^b Cubic feet per second.

* For this evaluation, this surface water body is located in the Ipswich River Watershed. This watershed will not be evaluated along the Surface Water Pathway.

[4; 5; 21; 22; 83; 84]

The Burlington Water Department operates a surface water intake on the Shawsheen River approximately 1.47 miles downstream of the property. The other 15-mile downstream surface water pathway flows via the intake into a pipeline to the Mill Pond Reservoir, which is located 3.13 miles southeast of the intake. Mill Pond supplies 80% of the residents of Burlington with drinking water [15; 16]. From Mill Pond, water empties into the Maple Meadow Brook. Flowing in a northeast direction, the Maple Meadow Brook feeds into the Ipswich River 3.67 miles downstream. The end of the second 15-mile downstream target distance limit is located 6.6 miles downstream on the Ipswich River. The flow of the second 15-mile downstream surface water pathway ranges from less than 10 to 77.9 cfs [3; 6; 15; 16; 61; 62; 63]. The following table summarizes the drinking water intakes along the 15-mile downstream pathway from the Roy Bros property.

Drinking Water Intakes Along the 15-Mile Downstream Pathway

Intake Name	Water Body	Downstream Distance From PPE	Flow Rate at Intake	Estimated Population Served
Burlington	Shawsheen River	1.47 miles	57.9 cfs	18,191

cfs = Cubic feet per second.

[15; 16]

SURFACE WATER PATHWAY (Continued)

Both Shawsheen and Ipswich Rivers are classified as Class B along their lengths within the 15-mile downstream pathway. Class B designated uses include recreational use, fish and wildlife habitat, agricultural and industrial supply and other legitimate uses including navigation. The Mill Pond reservoir is categorized as Class A along its length within 15-miles downstream of the property. Class A designates a body of water as a source of public water supply, serve as excellent habitats for fish, other aquatic life and wildlife, and are suitable for primary and secondary contact recreation. According to the MA DEP, the Shawsheen River, Ipswich River, and Mill Pond are designated for protection as outstanding resources waters [7, pp. 83-91].

The Massachusetts Natural Heritage and Endangered Species Program indicated that three Federally-listed or proposed threatened and endangered species are known to occur along the 15-mile surface water pathway in the Shawsheen River Watershed. Approximately 17.5 miles of wetland frontage exist along the Shawsheen River watershed portion of the 15-mile surface water pathway [2, p. 12; 3; 49; 82; 83; 84; 5]. For this evaluation, the Federally- and State-listed or proposed threatened and endangered species and wetland frontage along Ipswich River Watershed portion of the 15-mile surface water pathway were not determined. The following table summarizes the sensitive environments along the 15-mile downstream pathway from the Roy Bros property.

**Sensitive Environments Along the 15-Mile Downstream Pathway from
Roy Bros Haulers**

Sensitive Environment Type	Water Body	Downstream Distance From PPE	Flow Rate at Environment
Federal Endangered Candidate	Shawsheen River	3.02 miles	10-100 cfs
Wetlands (17.5 acres of frontage)	Shawsheen River	0 - 15 miles	10-100 cfs
Federal Endangered Candidate	Shawsheen River	6.83 miles	10-100 cfs

cfs = Cubic feet per second

[5; 49; 82; 83; 84]

On 13 February 1981, an environmental sample was collected in the adjacent wetland by MA DEP personnel during a source sampling event. The sediment sample was analyzed for VOCs and SVOCs using EPA Method 624. QA/QC consisted of a matrix spike. The collection of a reference sample was not discussed [31; 32]. The following table summarizes the analytical results.

SURFACE WATER PATHWAY (Continued)

Summary of Analytical Results: Highest Concentrations Detected Sediment Sample Analysis for Roy Bros Haulers 13 February 1981 Performed by Massachusetts Department of Environmental Protection

Sample Location	Compound/Element	Sample Concentration	Reference Concentration	Comments
Wetland (003565)	VOCs			
	Toluene	204 ppb	6.0 ppb	34 x MDL
	SVOCs			
	Acetone	221 ppb	25.0 ppb	8 x MDL
	Methyl ethyl ketone	241 ppb	25.0 ppb	9 x MDL

VOCs = Volatile organic compounds.
SVOCs = Semivolatile organic compounds.
MDL = Method detection limit.
ppb = Parts per billion.

[31; 32]

On 27 February 1981, MA DEP personnel collected additional water samples in the Shawsheen River. Each sample was analyzed for VOCs and SVOCs using EPA Method 624. QA/QC consisted of a matrix spike. The collection of a reference sample was not discussed [33]. The following analytical results indicate the presence of methylene chloride and chloroform downstream of the Roy Bros property.

Summary of Analytical Results: Highest Concentrations Detected Sediment Sample Analysis for Roy Bros Haulers 27 February 1981 Performed by Massachusetts Department of Environmental Protection

Substance	Concentration		
	Upstream of Roy Bros	Downstream of Roy Bros	Near Burlington Intake
Chloroform	ND	2.1 ppb	ND
1,1,1-trichloroethane	2.4 ppb	2.1 ppb	2.4 ppb
Trichloroethylene	< 1.0 ppb	< 1.0 ppb	< 1.0 ppb
Methylene Chloride	ND	5.7 ppb	ND

ND = None detected.
ppb = Parts per billion.

[33; 34]

SURFACE WATER PATHWAY (Continued)

An in situ water sample was collected by MA DEP personnel in the adjacent wetlands on 21 April 1983. At the time of sampling, the eastern edge of the property was flooded due to excess rain. The results indicated a temperature of 9°C, pH of 5, and conductivity of 260 umhos per centimeter [35].

On 19 December 1995, START personnel collected eight sediment samples on site and in the adjacent wetlands. All sampling activities were conducted in accordance with the approved Task Work Plan dated 17 November 1995 with the exception of the locations of sample stations SD-07 and SD-08 which were altered to further determine the extent of migration of hazardous materials into the wetland. During sampling, a flame ionization detector (FID) was used to screen sediments prior to sample collection. A maximum concentration of 100 units above background was detected at sample location SD-01 by a FID [2, p. 23].

Sediment samples collected by START personnel were submitted for VOC, SVOC, pesticide/PCB, total metals, and cyanide analyses through the EPA CLP. Sediment samples SD-05 and SD-06 were collected approximately 446 feet south of SD-01 upstream along Shawsheen River. SD-05 and SD-06 were considered the reference samples for samples SD-01, SD-02, SD-03, SD-04, SD-07, and SD-08 [2, pp. 1-23].

Analytical results of samples collected from the Shawsheen River at sample location SD-01 indicate the presence of one SVOC, fluoranthene, and one pesticide compound, 4,4'-DDD, at concentrations above the associated SQL. Inorganic elements, cadmium and zinc, were also observed above reference concentrations at sample location SD-01 [79; 80].

Samples collected at the PPE detected the following VOCs and SVOCs at concentrations above the respective SQL: carbon disulfide and bis(2-ethylhexyl)phthalate. Results for bis(2-ethylhexyl)phthalate were reported from diluted analyses. The pesticide and PCB compounds, 4,4'-DDD and aroclor 1254, were observed at concentrations above the SQL. Analytical results also indicated the presence of the inorganic elements, arsenic and chromium, above reference concentrations at sample locations SD-03 and SD-04. Mercury was detected above the CDL at sample location SD-03 [79; 80].

Only one VOC, 2-hexanone at sample location SD-08, was detected downgradient of the PPE in the wetland area adjacent to the Roy Bros property. In addition, the following inorganic elements were observed above their respective reference and CDL concentrations at sample location SD-08: beryllium, cadmium, mercury, and selenium [79; 80].

Based on the facility's operational history, the historical disposal practices at the property, and the fact that 6 of 13 compounds detected in the sediment samples were previously reported at detectable concentrations in source samples, waste constituents detected in the sediment samples are likely attributable to on-site processes [21; 31; 32; 70; 71; 79; 80].

SI TABLE 7: SURFACE WATER OBSERVED RELEASE SUBSTANCES

List all substances that meet the criteria for an observed release to surface water; however do not eliminate a substance from this table if it has a BCF of less than 500.

Sample ID	Hazardous Substance	Substance Concentration	Bckgrd. ID.	Bckgrd. Conc.	BCF HRS Table 4-15	Toxicity × Persistence	Toxicity × Persis. × Bioaccum	Ecotoxicity × Persis. × Ecobioaccum	References
MA DEP (003585)	Toluene Acetone Methyl ethyl ketone	204 ppb 221 ppb 241 ppb	None None None	None None None	50.0 0.5 0.5	20.0 4.0 4.0	1,000 2.0 2.0	2,000 20.0 0.20	31; 32 31; 32 31; 32
MA DEP River sampling	Methylene Chloride Chloroform	5.7 ppb 2.1 ppb	Upstream Location	ND ND	5.0 5.0	4.0 40.0	20.0 200.0	2.0 20.0	33; 34 33; 34
SD-01	Fluoranthene 4,4'-DDD Cadmium Zinc	840 ppb 9.4 J ppb 1.7 mg/kg 387 mg/kg	SD-05 SD-05 SD-06 SD-05	820 U ppb 8.2 U ppb 0.24 mg/kg 18.4 mg/kg	5,000 50,000 5,800 500	100 100 10,000 5,000	5.0E+05 5.0E+06 5.0E+07 5,000	5.0E+05 5.0E+08 5.0E+06 5,000	79; 81 79; 81 80; 81 80; 81
SD-03	Carbon disulfide Bis(2-ethylhexyl)phthalate 4,4'-DDD Aroclor 1254 Arsenic Chromium Mercury	48 J ppb 6,300 ppb 21 J ppb 130 ppb 21.9 mg/kg 48.3 mg/kg 0.10 J mg/kg	SD-05 SD-05 SD-05 SD-05 SD-05 SD-05 CDL	25 U ppb 820 U ppb 8.2 U ppb 82 U ppb 2.6 mg/kg 15.5 mg/kg 0.10 mg/kg	500.0 50,000 50,000 50,000 5.0 5.0 50,000	400 100 100 10,000 10,000 10,000 10,000	2.0E+05 5.0E+06 5.0E+06 5.0E+08 50,000 50,000 5.0E+08	20,000 5.0E+07 5.0E+08 5.0E+08 50,000 50,000 5.0E+08	79; 81 79; 81 79; 81 79; 81 80; 81 80; 81 80; 81
SD-04	Bis(2-ethylhexyl)phthalate 4,4'-DDD Aroclor 1254 Arsenic	7,500 ppb 20 ppb 120 ppb 18.6 mg/kg	SD-05 SD-05 SD-05 SD-05	82 U ppb 820 U ppb 8.2 U ppb 2.6 ppb	50,000 50,000 50,000 5.0	10,000 100 100 10,000	5.0E+08 5.0E+06 5.0E+06 50,000	5.0E+08 5.0E+07 5.0E+08 50,000	79; 81 79; 81 79; 81 80; 81
SD-08	2-hexanone Beryllium Cadmium Mercury Selenium	200 J ppb 2.3 mg/kg 0.80 mg/kg 0.19 J mg/kg 4.7 J mg/kg	SD-05 SD-06 SD-06 CDL SD-06	25 U ppb 0.62 mg/kg 0.24 mg/kg 0.10 mg/kg 1.4 J mg/kg	5.0 50.0 5,000 50,000 5,000	0.40 10,000 10,000 10,000 100	2.0 5.0E+05 5.0E+05 5.0E+08 5.0E+05	0.40 — 5.0E+06 5.0E+08 5.0E+06	79; 81 80; 81 80; 81 80; 81 80; 81
Highest Values						10,000	5.0E+08	5.0E+08	

Notes: Sediment samples, SD-01, SD-02, SD-03, SD-04, SD-05, SD-06, and SD-08 were collected by START personnel on 19 December 1996 [72, pp. 11-12]. Between 13 and 27 February 1997, MA DEP personnel collected sediment and surface water samples in the adjacent wetland and in the Shawsheen River. CDL denotes contract detection limit. ND denotes non-detect.

SI TABLE 8: SURFACE WATER DRINKING WATER ACTUAL CONTAMINATION TARGETS

Notes: Convert all results and SCDM values to ppb or $\mu\text{g/L}$.

If sum of percents calculated for I or J index is ≥ 100 percent, consider the intake a Level I target; if sum of I or J index is < 100 percent consider the intake a Level II target.

Intake ID:		Sample Type:		Level I:	Level II:	Population Served:		References:	
Sample ID	Hazardous Substance	Conc. ($\mu\text{g/L}$)	Benchmark Conc. (MCL or MCLG)	% of Benchmark	RfD (J Index)	% of RfD	Cancer Risk Conc. (I index)	% of Cancer Risk Conc.	
				Highest Percent	Sum of Percents		Sum of Percents		

SCDM Version: JUL95

Notes: On 27 February 1981, MA DEP personnel collected surface water samples near the Burlington intake located approximately 1.5-miles downstream of the Roy Bros Haulers property along the Shawsheen River. No substances were detected above reference concentrations [33].

SURFACE WATER PATHWAY LIKELIHOOD OF RELEASE AND DRINKING WATER THREAT WORKSHEET

LIKELIHOOD OF RELEASE - OVERLAND/FLOOD MIGRATION

	Score	Data Type	Refs												
1. OBSERVED RELEASE: If sampling data or direct observation support a release to surface water in the watershed, assign a score of 550. Record observed release substances on SI Table 7.	550	+	79; 80												
2. POTENTIAL TO RELEASE: Distance to surface water: <u>675</u> (feet) If sampling data do not support a release to surface water in the watershed, use the table below to assign a score from the table below based on distance to surface water and flood frequency.															
<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td>Distance to surface water < 2500 feet</td> <td style="text-align: center;">500</td> </tr> <tr> <td>Distance to surface water > 2500 feet, and:</td> <td></td> </tr> <tr> <td>Site in annual or 10-yr floodplain</td> <td style="text-align: center;">500</td> </tr> <tr> <td>Site in 100-yr floodplain</td> <td style="text-align: center;">400</td> </tr> <tr> <td>Site in 500-yr floodplain</td> <td style="text-align: center;">300</td> </tr> <tr> <td>Site outside 500-yr floodplain</td> <td style="text-align: center;">100</td> </tr> </table>	Distance to surface water < 2500 feet	500	Distance to surface water > 2500 feet, and:		Site in annual or 10-yr floodplain	500	Site in 100-yr floodplain	400	Site in 500-yr floodplain	300	Site outside 500-yr floodplain	100			
Distance to surface water < 2500 feet	500														
Distance to surface water > 2500 feet, and:															
Site in annual or 10-yr floodplain	500														
Site in 100-yr floodplain	400														
Site in 500-yr floodplain	300														
Site outside 500-yr floodplain	100														
Optionally, evaluate surface water potential to release according to HRS Section 4.1.2.1.2															
LR =	550														

LIKELIHOOD OF RELEASE - Groundwater TO SURFACE WATER MIGRATION

	Score	Data Type	Refs
1. OBSERVED RELEASE: If sampling data or direct observation support a release to surface water in the watershed, assign a score of 550. Record observed release substances on SI Table 7.			
NOTE: Evaluate ground water to surface water migration only for a surface water body that meets all of the following conditions:			
1) A portion of the surface water is within 1 mile of site sources having a containment factor greater than 0.			
2) No aquifer discontinuity is established between the source and the above portion of the surface water body.			
3) The top of the uppermost aquifer is at or above the bottom of the surface water.			
Elevation of top of uppermost aquifer: _____			
Elevation of bottom of surface water body: _____			
2. POTENTIAL TO RELEASE: Depth to aquifer: <u>4</u> feet. If sampling data do not support a release to the aquifer, and the site is in karst terrain or the depth to aquifer is 70 feet or less assign a score of 500; otherwise assign a score of 340. Optionally, evaluate potential to release according to HRS Section 3.1.2.			
LR =	NE		

NOTES: NE denotes not evaluated.

SURFACE WATER PATHWAY LIKELIHOOD OF RELEASE AND DRINKING WATER THREAT WORKSHEET (Continued)

DRINKING WATER THREAT TARGETS

Data	Score	Type	Refs												
<p>Record the water body type, flow, and number of people served by each drinking water intake within the distance limit in the watershed. If there is no drinking water intake within the target distance limit, assign 0 to factors 3, 4, and 5.</p> <table border="1" style="width: 100%; margin: 10px 0;"> <thead> <tr> <th>Intake Name</th> <th>Water Body Type</th> <th>Flow</th> <th>People Served</th> </tr> </thead> <tbody> <tr> <td>Burlington</td> <td>Moderate Stream</td> <td>10-100 cfs</td> <td>18,191</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> <p>Are any intakes part of a blended system? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If yes, attach a page to show apportionment calculations.</p> <p>3. ACTUAL CONTAMINATION TARGETS: If analytical evidence indicates a drinking water intake has been exposed to a hazardous substance from the site, list the intake name and evaluate the factor score for the drinking water population (SI Table 8).</p> <p>Level I: $\frac{0}{0} \text{ people} \times 10 = \frac{0}{0}$ Level II: $\frac{0}{0} \text{ people} \times 1 = \frac{0}{0}$ Total =</p>	Intake Name	Water Body Type	Flow	People Served	Burlington	Moderate Stream	10-100 cfs	18,191					0	+	6; 15; 16
Intake Name	Water Body Type	Flow	People Served												
Burlington	Moderate Stream	10-100 cfs	18,191												
<p>4. POTENTIAL CONTAMINATION TARGETS: Determine the number of people served by drinking water intakes for the watershed that have not been exposed to a hazardous substance from the site. Assign the population values from SI Table 9. Sum the values and multiply by 0.1.</p>	163.3	+	6; 15; 16												
<p>5. NEAREST INTAKE: Assign a score of 50 for any Level I Actual Contamination Drinking Water Targets for the watershed. Assign a score of 45 if there are Level II targets for the watershed, but no Level I targets. If no Actual Contamination Drinking Water Targets exist, assign a score for the intake nearest the PPE from SI Table 9. If no drinking water intakes exist, assign 0.</p>	2	+	3; 6; 15; 16												
<p>6. RESOURCES: Assign a score of 5 if one or more surface water resource applies; assign 0 if none applies.</p> <ul style="list-style-type: none"> • Irrigation (5 acre minimum) of commercial food crops or commercial forage crops • Watering of commercial livestock • Ingredient in commercial food preparation • Major or designated water recreation area, excluding drinking water use. 	5	+	3												
Sum of Targets T =	170.3														

SI TABLE 9 (FROM HRS TABLE 4-14): DILUTION-WEIGHTED POPULATION VALUES FOR POTENTIAL CONTAMINATION FOR SURFACE WATER MIGRATION PATHWAY^(a)

Type of Surface Water Body ^(b)	Pop.	Nearest Intake	NUMBER OF PEOPLE								Pop. Value
			1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000	
Minimal Stream (< 10 cfs)	0	20	4	17	53	164	522	1,633	5,214	16,325	0
Small to moderate stream (10 to 100 cfs)	18,191	2	0.4	2	5	16	52	163	521	1,633	1,633
Moderate to large stream (> 100 to 1,000 cfs)	0	0	0.04	0.2	0.5	2	5	16	52	163	0
Large Stream to river (> 1,000 to 10,000 cfs)	0	0	0.004	0.02	0.05	0.2	0.5	2	5	16	0
Large River (> 10,000 to 100,000 cfs)	0	0	0	0.002	0.005	0.02	0.05	0.2	0.5	2	0
Very Large River (> 100,000 cfs)	0	0	0	0	0.001	0.002	0.005	0.02	0.05	0.2	0
Shallow ocean zone or Great Lake (depth < 20 feet)	0	0	0	0.002	0.005	0.02	0.05	0.2	0.5	2	0
Moderate ocean zone or Great Lake (Depth 20 to 200 feet)	0	0	0	0	0.001	0.002	0.005	0.02	0.05	0.2	0
Deep ocean zone or Great Lake (depth > 200 feet)	0	0	0	0	0	0.001	0.003	0.008	0.03	0.08	0
3-mile mixing zone in quiet flowing river (\geq 10 cfs)	0	10	2	9	26	82	261	817	2,607	8,162	0

SI TABLE 9 (FROM HRS TABLE 4-14): DILUTION-WEIGHTED POPULATION VALUES FOR POTENTIAL CONTAMINATION FOR SURFACE WATER MIGRATION PATHWAY^(a) (Continued)

Type of Surface Water Body	Pop.	NUMBER OF PEOPLE					Pop. Value
		30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,001 to 3,000,000	3,000,001 to 10,000,000	
Minimal Stream (< 10 cfs)	0	52,137	163,246	521,360	1,632,455	5,213,590	0
Small to moderate stream (10 to 100 cfs)	0	5,214	16,325	52,136	163,245	521,359	0
Moderate to large stream (> 100 to 1,000 cfs)	0	521	1,633	5,214	16,325	52,136	0
Large Stream to river (> 1,000 to 10,000 cfs)	0	52	163	521	1,632	5,214	0
Large River (> 10,000 to 100,000 cfs)	0	5	16	52	163	521	0
Very Large River (> 100,000 cfs)	0	0.5	2	5	16	52	0
Shallow ocean zone or Great Lake (depth < 20 feet)	0	5	16	52	163	521	0
Moderate ocean zone or Great Lake (Depth 20 to 200 feet)	0	0.5	2	5	16	52	0
Deep ocean zone or Great Lake (depth > 200 feet)	0	0.3	1	3	8	26	0
3-mile mixing zone in quiet flowing river (\geq 10 cfs)	0	26,068	81,623	260,680	816,227	2,606,793	0
Sum =							1,633

^aRound the number of people to nearest integer. Do not round the assigned dilution-weighted population value to nearest integer.

^bTreat each lake as a separate type of water body and assign it a dilution-weighted population value using the surface water body type with the same dilution weight from HRS Table 4-13 as the lake. If drinking water is withdrawn from coastal tidal water or the ocean, assign a dilution-weighted population value to it using the surface water body type with the same dilution weight from HRS Table 4-13 as the coastal tidal water or the ocean zone.

SI TABLE 10: HUMAN FOOD CHAIN ACTUAL CONTAMINATION TARGETS FOR WATERSHED

Notes: Convert all results and SCDM values to $\mu\text{g/kg}$ or ppb.

If sum of percents calculated for I or J index is $\geq 100\%$, consider the fishery a Level I target; if sum of I or J index is < 100 percent consider the fishery a Level II target. List only those substances that meet the observed release criteria in a fishery within the target distance limit and have a BCF of ≥ 500 ; BCF values are found on SI Table 7.

Fishery ID: Shawsheen River		Sample Type: Sediment		Level I:		Level II: ✓		References: 79; 80	
Sample ID	Hazardous Substance	Conc. (µg/kg)	Benchmark Conc. (FDAAL)	% of Benchmark	RfD (J index)	% of RfD	Cancer Risk Conc. (I index)	% of Cancer Risk Conc.	
SD-01	Fluoranthene	840 ppb	NL	NA	NL	NA	NL	NA	
	4,4'-DDT	9.4 J ppb	NL	NA	NL	NA	NL	NA	
	Cadmium	1.7 ppb	NL	NA	NL	NA	NL	NA	
	Zinc	387 ppb	NL	NA	NL	NA	NL	NA	
			Highest Percent	NA	Sum of Percents	NA	Sum of Percents	NA	

Notes: Sediment samples can be used to document Level II contamination only.

Reference Sample: SD-05; SD-06.

SI TABLE 11: SENSITIVE ENVIRONMENT ACTUAL CONTAMINATION TARGETS FOR WATERSHED

Notes: Convert all results and SCDM values to $\mu\text{g/L}$ or ppb .

If the highest % of benchmark calculated is $\geq 100\%$, consider the sensitive env. a Level I target; if the highest % of benchmark calculated is $< 100\%$ consider the sensitive env. a Level II target.

Environment ID: Wetland		Sample Type: Sediment		Level I:	Level II: ✓	Environment Value: 25	
Sample ID	Hazardous Substance	Conc. (µg/L)	Benchmark Conc. (AWQC or AALAC)	% of Benchmark	References		
SD-01	Fluoranthene	840 µg/L	NL	NA	79; 81		
	4,4'-DDD	9.4 µg/L	NL	NA	79; 81		
	Cadmium	1,700 µg/L	NL	NA	80; 81		
	Zinc	387 µg/L	NL	NA	80; 81		
SD-03	Carbon disulfide	48 J µg/L	NL	NA	79; 81		
	Bis(2-ethylhexyl)phthalate	6,300 µg/L	NL	NA	79; 81		
	4,4'-DDD	21 J µg/L	NL	NA	79; 81		
	Aroclor 1254	130 µg/L	NL	NA	80; 81		
	Arsenic	21,900 µg/L	NL	NA	80; 81		
	Chromium	48,300 µg/L	NL	NA	80; 81		
	Mercury	100 J µg/L	NL	NA	80; 81		
SD-04	Bis(2-ethylhexyl)phthalate	130 µg/L	NL	NA	79; 81		
	4,4'-DDD	20 µg/L	NL	NA	79; 81		
	Aroclor 1254	120 µg/L	NL	NA	79; 81		
	Arsenic	18,600 µg/L	NL	NA	80; 81		
SD-08	2-hexanone	200 J µg/L	NL	NA	79; 81		
	Beryllium	2.3 µg/L	NL	NA	80; 81		
	Cadmium	800 µg/L	NL	NA	80; 81		
	Mercury	190 J µg/L	NL	NA	80; 81		
	Selenium	4,700 J µg/L	NL	NA	80; 81		
Highest Percent				NA			

SCDM Version: JUL95

Notes: Sediment samples can be used to document Level II contamination only. Samples SD-03 and SD-04 were collected at the probable point of entry (PPE). Sample SD-01 was collected at the western edge of the Shawsheen River approximately 750 feet west of the PPE. Sample SD-08 was located approximately 264 feet northwest of the PPE in the wetland area [2].

NL and NA denote not applicable for this evaluation.

Reference Sample: SD-05; SD-06.

SURFACE WATER PATHWAY (Continued) HUMAN FOOD CHAIN THREAT WORKSHEET

HUMAN FOOD CHAIN THREAT TARGETS			Score	Data Type	Refs
Record the water body type and flow for each fishery within the target distance limit. If there is no fishery within the target distance limit, assign a score of 0 at the bottom of this page.					
Fishery Name: Shawsheen River Species: Unknown	Water Body: Moderate Stream Production: >0	Flow: 10-100 cfs lbs/yr		+	6
Species:	Production:	lbs/yr			
Fishery Name:	Water Body:	Flow: cfs			
Species:	Production:	lbs/yr			
Species:	Production:	lbs/yr			
FOOD CHAIN INDIVIDUAL (Select highest value)					
7. ACTUAL CONTAMINATION FISHERIES: Assign 50 points for a Level I fishery only if tissue samples document an observed release of a substance with a BCF \geq 500 to a fishery within the target distance limit (SI Table 10). List substance(s): _____ Assign 45 points for a Level II fishery if surface water/sediment samples document an observed release of a substance with a BCF \geq 500 to a fishery within the target distance limit (SI Table 10). List substance(s): <u>Fluoranthene, 4,4'-DDD.</u>			45	+	79; 80
8. POTENTIAL CONTAMINATION FISHERIES: Assign 20 points for a potential fishery if there is an observed release of a substance with a BCF \geq 500 (SI Table 7) to a watershed containing fisheries within the target distance limit, but no Level I or Level II fisheries are scored because there is no fishery documented between the PPE and the most downstream observed release sample point. If there is no observed release of a substance with a BCF \geq 500 to a watershed, assign a value for potential contamination fisheries from the table below using the lowest flow of all fisheries within the target distance limit.					
Lowest Flow	FCI Value				
< 10 cfs	20				
10 to 100 cfs	2				
> 100 cfs, coastal tidal waters, oceans, or Great Lakes	0				
3-mile mixing zone in quiet flowing river	10				
FCI Value =			0		
Targets T =			45		

Notes:

SURFACE WATER PATHWAY (Continued) ENVIRONMENTAL THREAT WORKSHEET

When measuring length of wetlands that are located on both sides of a surface water body, sum both frontage lengths. For a sensitive environment that is more than one type, assign a value for each type.

ENVIRONMENTAL THREAT TARGETS

					Score	Data Type	Refs
Record the water body and flow for each surface water sensitive environment within the target distance limit (see SI Table 12). If there is no sensitive environment within the target distance limit, assign a score of 0 at the bottom of the page.							
Environment Type (SI Table 13)		Water Body Name		Flow			
Wetland		Shawsheen River		10-100 cfs		+	3; 6
Federal Endangered Candidate (3)		Shawsheen River		10-100 cfs			
Clean Water Act		Shawsheen River		10-100 cfs			
9. ACTUAL CONTAMINATION SENSITIVE ENVIRONMENTS: If sampling data or direct observation indicate any sensitive environment has been exposed to a hazardous substance from the site, record this information on SI Table 11, and assign a factor value for the environment (SI Tables 13 and 14). Substance(s): <u>4,4'-DDD</u> From Table: <u>14</u>							
Environment Type (SI Table 13)	Environment Value (SI Tables 13 & 14)	Multiplier (10 for Level I, 1 for Level II)		Product			
Wetland (0.1 miles)	25	× 1		= 25		+	3; 6
Clean Water Act	5	× 1		= 5			
		×		=			
		×		=			
		×		=			
Sum =					30	+	79;80
10. POTENTIAL CONTAMINATION SENSITIVE ENVIRONMENTS:							
Flow	Dilution weight (SI Table 12)	Environment Type and Value (SI Tables 13 & 14)		Pot. Cont.	Product		
10-100 cfs	0.1 ×	Wetland (17.4 miles) × 450		0.1 =	4.5	+	3; 6; 50
10-100 cfs	0.1 ×	3 × Federal Endangered Candidate × 50		0.1 =	1.5	+	3; 6; 50
cfs	×	×		0.1 =			
cfs	×	×		0.1 =			
Sum =					6.0		
Sum of Targets T =					36.0		

Notes:

**SI TABLE 12 (HRS TABLE 4-13):
SURFACE WATER DILUTION WEIGHTS**

* TYPE OF SURFACE WATER BODY		Assigned Dilution Weight
Descriptor	Flow Characteristics	
Minimal stream	< 10 cfs	1
✓ Small to moderate stream	10 to 100 cfs	0.1
Moderate to large stream	> 100 to 1,000 cfs	0.01
Large stream to river	> 1,000 to 10,000 cfs	0.001
Large river	> 10,000 to 100,000 cfs	0.0001
Very large river	> 100,000 cfs	0.00001
Coastal tidal waters	Flow not applicable; depth not applicable	0.0001
Shallow ocean zone or Great Lake	Flow not applicable; depth less than 20 feet	0.0001
Moderate depth ocean zone or Great Lake	Flow not applicable; depth 20 to 200 feet	0.00001
Deep ocean zone or Great Lake	Flow not applicable; depth greater than 200 feet	0.000005
3-mile mixing zone in quiet flowing river	10 cfs or greater	0.5

* Check all (✓) appropriate dilution weights.

Notes:

**SI TABLE 13 (HRS TABLE 4-23)
SURFACE WATER AND AIR SENSITIVE ENVIRONMENTS VALUES**

*	Sensitive Environment	Assigned Value
	Critical habitat for Federal designated endangered or threatened species Marine Sanctuary National Park Designated Federal Wilderness Area Ecologically important areas identified under the Coastal Zone Wilderness Act Sensitive Areas identified under the National Estuary Program or Near Coastal Water Program of the Clean Water Act Critical Areas identified under the Clean Lakes Program of the Clean Water Act (subareas in lakes or entire small lakes) National Monument (air pathway only) National Seashore Recreation Area National Lakeshore Recreation Area	100
	Habitat known to be used by Federal designated or proposed endangered or threatened species National Preserve National or State Wildlife Refuge Unit of Coastal Barrier Resources System Coastal Barrier (undeveloped) Federal land designated for the protection of natural ecosystems Administratively Proposed Federal Wilderness Area Spawning areas critical for the maintenance of fish/shellfish species within a river system, bay, or estuary Migratory pathways and feeding areas critical for the maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which the fish spend extended periods of time Terrestrial areas utilized by large or dense aggregations of vertebrate animals (semi-aquatic foragers) for breeding National river reach designated as recreational	75
✓	Habitat known to be used by State designated endangered or threatened species Habitat known to be used by a species under review as to its Federal endangered or threatened status Coastal Barrier (partially developed) Federally designated Scenic or Wild River	50
	State land designated for wildlife or game management State Designated Scenic or Wild River State designated Natural Area Particular areas, relatively small in size, important to maintenance of unique biotic communities	25
✓	State designated areas for the protection and maintenance of aquatic life under the Clean Water Act	5
✓	Wetlands See SI Table 14 (Surface Water Pathway) or SI Table 23 (Air Pathway)	

*Check (✓) all environments impacted or potentially impacted by the site.

SI TABLE 14 (HRS TABLE 4-24): SURFACE WATER WETLANDS FRONTAGE VALUES

*	TOTAL LENGTH OF WETLANDS	ASSIGNED VALUE
	Less than 0.1 mile	0
✓	0.1 to 1 mile	25
	Greater than 1 to 2 miles	50
	Greater than 2 to 3 miles	75
	Greater than 3 to 4 miles	100
	Greater than 4 to 8 miles	150
	Greater than 8 to 12 miles	250
	Greater than 12 to 16 miles	350
✓	Greater than 16 to 20 miles	450
	Greater than 20 miles	500

* Check (✓) highest value for each applicable flow characteristic.

Notes:

SURFACE WATER PATHWAY (Concluded)

WASTE CHARACTERISTICS, THREAT, AND PATHWAY SCORE SUMMARY

WASTE CHARACTERISTICS

Score

11. If an Actual Contamination Target (drinking water, human food chain, or environmental threat) exists for the watershed, assign the calculated hazardous waste quantity score, or a score of 100, whichever is greater. If no Actual Contamination Targets exist, assign the hazardous waste quantity score calculated for sources available to migrate to surface water.

10,000

12. Assign the highest value from SI Table 3 or SI Table 7 for the hazardous substance waste characterization factors below. Multiply each by the surface water hazardous waste quantity score and determine the waste characteristics score for each threat.

	DWT	HFCT	ET
Substance(s):	PCB	PCB	PCB
Value:	10,000.0	5.0E+08	5.0E+08
From Table:	7	7	7

*Footnote all substances which cannot fit on Table.

13. Multiply the toxicity and hazardous waste quantity scores. Assign the waste characteristics score for each threat from the table below.

Product	WC Score	DWT	HFCT	ET
0	0			
>0 to <10	1			
≥10 to <100	2			
≥100 to <1,000	3			
≥1,000 to <10,000	6			
≥10,000 to <1E+05	10			
≥1E+05 to <1E+06	18			
≥1E+06 to <1E+07	32			
≥1E+07 to <1E+08	56			
≥1E+08 to <1E+09	100			
≥1E+09 to <1E+10	180			
≥1E+10 to <1E+11	320			
≥1E+11 to <1E+12	560			
≥1E+12 or greater	1000		✓	✓

*check (✓) the WC score calculated for each threat

	Substance Value	HWQ	Product	WC Score (from Table)	
Drinking Water Threat Toxicity/Persistence	10,000 x	10,000 =	1.0E+08	100	(Maximum of 100)
Food Chain Threat Toxicity/Persistence Bioaccumulation	5.0E+08 x	10,000 =	5.0E+12	1,000	(Maximum of 1000)
Environmental Threat Ecotoxicity/Persistence Ecobioaccumulation	5.0E+08 x	10,000 =	5.0E+12	1,000	(Maximum of 1000)

SURFACE WATER PATHWAY THREAT SCORES

Threat (T)	Likelihood of Release (LR) Score	Targets (T) Score	Pathway Waste Characteristics (WC) Score (determined above)	Threat Score $\frac{LR \times T \times WC}{82,500}$	
Drinking Water (DW)	550	170.3	100	100	(Maximum of 100)
Human Food Chain (HFC)	550	45	1,000	100	(Maximum of 100)
Environmental (E)	550	36	1,000	60.0	(Maximum of 60)

Multiply LR by T and by WC. Divide the product by 82,500 for each threat (T). Sum the threat scores to obtain the surface water pathway score for each watershed/migration route. Select the highest watershed/migration route score. If the pathway score is greater than 100, assign 100.

SURFACE WATER PATHWAY CALCULATION:
(DW + HFC + E) =

100

(Maximum of 100)

Notes:

Drinking Water (DW):

$$\frac{550 \times 170.3 \times 100}{82,500} = 113.5$$

Human Food Chain (HFC):

$$\frac{550 \times 45 \times 1,000}{82,500} = 300$$

Environmental (E):

$$\frac{550 \times 36 \times 1,000}{82,500} = 240$$

$$DW + HFC + E: 100 + 100 + 60 = 260$$

SOIL EXPOSURE PATHWAY

Pathway Description and Scoring Notes: Identify all areas of observed contamination. Indicate whether a resident population is associated with the site and characterize the area surrounding the site. Identify the nearby population and any terrestrial sensitive environments located within the target distance limit.

Briefly discuss any sampling events relative to the Soil Exposure Pathway; provide dates of sampling events and a summary of the analytical results and whether an observed release and/or actual contamination targets were documented.

Indicate any assumptions you have made in scoring the Soil Exposure Pathway for this site, or any key factors which influenced your scoring rationale.

The property is easily accessible to the public. No visible barriers to access exist other than the adjacent wetlands which provide a natural barrier to access on the northern and eastern boundaries of the property [3; 61; 62; 63].

The nearest residence is located along Allen Road in Billerica, Massachusetts. The residence is located topographically upgradient and approximately 210 feet southwest of the former western infiltration lagoon. The residence is specified as Lot 26 Plate 90 on the Billerica Tax Assessor's Map [2, pp. 12-14; 66].

There are no schools or day-care facilities are known to be located within 200 feet of an area of observed contamination. The nearest school is the Ditson School located on Boston Road approximately 0.6 miles southeast of the property [3].

There are 50 workers on site [2, p. 2]. An estimated 5,765 people live within 1-radial mile and 81,724 people live within 4-radial miles of the Roy Bros property [17]. Table 14 summarizes the population located within 4-radial miles of the Roy Bros property.

Table 14

Estimated Population Within 4-Radial Miles of Roy Bros Haulers

Radial Distance From Roy Bros Haulers (miles)	Estimated Population
On-site	50
0.00 < 0.25	416
0.25 < 0.50	1,257
0.50 < 1.00	4,092
1.00 < 2.00	17,215
2.00 < 3.00	24,741
3.00 < 4.00	34,002
TOTAL	81,773

[3; 17; 61; 62; 63]

SOIL EXPOSURE PATHWAY (Continued)

Paulding collected soil (source) samples on 18 May 1995 during the advancement of test borings by Soil Exploration Corporation. The borings were advanced in the vicinity of the former western and eastern lagoon areas. The samples were analyzed by IEA for priority pollutant metals, VOCs, and SVOCs. Elevated levels of bis(2-ethylhexyl)phthalate were detected in a majority of the samples analyzed for metals [21].

SI TABLE 15a: SOIL EXPOSURE OBSERVED CONTAMINATION SUBSTANCES

Source ID: Former eastern infiltration lagoon / former western infiltration lagoon

Sample ID	Hazardous Substance	Substance Concentration	Bckgrd. ID.	Bckgrd. Conc.	Toxicity	References
MW-7 #4a, E-4 #3B	1,2-dichlorobenzene	260 ppb	none	none	NL	21
TB-2 #1, TB-1 #5, E-2 #1,2,3, E-4 #3B, E-5 #1,2, MW-7 #4a	Ethyl Benzene	1,300 ppb	none	none	10	21
MW-7 #4a	Chlorobenzene	730 ppb	none	none	100	21
MW-7 #4a	Benzene	380 ppb	none	none	100	21
MW-7 #4a	N-butylbenzene	150 ppb	none	none	10	21
MW-7 #4a	T-butylbenzene	130 ppb	none	none	100	21
MW-7 #4a	P-isopropyltoluene	1,200 ppb	none	none	NL	21
E-2 #1,2,3, E-4 #3B, MW-7 #4a	Xylene	4,200 ppb	none	none	10	21
E-5 #1,2	Styrene	5,100 ppb	none	none	10	21
MW-7 #4A, E-2 #1,2,3, E-4 #3B, E-5 #1,2, TB-2 #1, TB-1 #5, TB-1 #1	Bis(2-ethylhexyl)phthalate	2,600,000 ppb	none	none	100	21
E-6 #1	Fluoranthene	8,900 ppb	none	none	100	21
E-6 #1	Phenanthrene	10,000 ppb	none	none	NL	21
E-6 #1	Pyrene	9,300 ppb	none	none	100	21
MW-7 #4a	1,2,4-trimethylbenzene	1,000 ppb	none	none	NL	21
MW-7 #4a	1,3,5-trimethylbenzene	300 ppb	none	none	NL	21
Highest Toxicity					100	

Notes: The Paulding Company collected these soil samples on May 18, 1995 during the advancement of test borings by Soil Exploration Corporation. The samples were analyzed by IEA [21].

Notes: Convert all results and SCDM values to $\mu\text{g/kg}$ or ppb.

Residence NO:

Residence ID:		Level I:		Level II:		Population:	
Sample ID	Hazardous Substance	Conc. (µg/kg)	RfD (Index)	% of RfD	Cancer Risk Conc. (Index)	% of Cancer Risk Conc.	References
Sum of Percents				Sum of Percents			

Notes: One residence is located immediately southwest of the Roy Bros property and is owned by Mr. Leo Roy, the current operator of Roy Bros. The residence is approximately 210 feet southwest of the former western infiltration lagoon. There is no indication that disposal practices occurred on this property within 200 feet of the residence.

SOIL EXPOSURE PATHWAY WORKSHEET

RESIDENT POPULATION THREAT

LIKELIHOOD OF EXPOSURE

	Score	Data Type	Refs
1. OBSERVED CONTAMINATION: If evidence indicates presence of observed contamination (depth of 2 feet or less), assign a score of 550; otherwise, assign a 0. Note that a likelihood of exposure score of 0 results in a soil exposure pathway score of 0.	550	+	21

LE =

TARGETS

2.	RESIDENT POPULATION: Determine the number of people occupying residences or attending school or day care on contaminated property and within 200 feet of areas of observed contamination (HRS section 5.1.3).																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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3.	RESIDENT INDIVIDUAL: Assign a score of 50 if any Level I resident population exists. Assign a score of 45 if there are Level II targets but no Level I targets. If no resident population exists (i.e., no Level I or Level II targets), assign 0 (HRS Section 5.1.3).	0	+	2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
4.	WORKERS: Assign a score from the table below for the total number of workers at the site and nearby facilities and within areas of observed contamination associated with the site.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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5.	TERRESTRIAL SENSITIVE ENVIRONMENTS: Assign a value for each terrestrial sensitive environment (SI Table 16) in an area of observed contamination.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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Notes:

SOIL EXPOSURE PATHWAY WORKSHEET NEARBY POPULATION THREAT

LIKELIHOOD OF EXPOSURE

		Score	Data Type	Ref.
7.	Attractiveness/Accessibility (from SI Table 17 or HRS Table 5-6)	Value: 40		
	Area of Contamination (from SI Table 18 or HRS Table 5-7)	Value: 20		
	Likelihood of Exposure (from SI Table 19 or HRS Table 5-8)	5	+	2,50,1
	LE=	5		

TARGETS

		Score	Data Type	Ref.
8.	Assign a score of 0 if Level I or Level II resident individual has been evaluated or if no individuals live within 1/4 mile travel distance of an area of observed contamination. Assign a score of 1 if nearby population is within 1/4 mile travel distance and no Level I or Level II resident population has been evaluated.	1	+	3,17,61 62,63
9.	Determine the population within 1 mile travel distance that is not exposed to a hazardous substance from the site (i.e., properties that are not determined to be Level I or Level II); record the population for each distance category in SI Table 20 (HRS Table 5-10). Sum the population values and multiply by 0.1.	6.6	+	3,17,61 62,63
	Sum of Targets T=	7.6		

Notes:

**SI TABLE 16 (HRS TABLE 5-5): SOIL EXPOSURE PATHWAY
TERRESTRIAL SENSITIVE ENVIRONMENT VALUES**

*	TERRESTRIAL SENSITIVE ENVIRONMENT	ASSIGNED VALUE
	Terrestrial critical habitat for Federal designated endangered or threatened species National Park Designated Federal Wilderness Area National Monument	100
	Terrestrial habitat known to be used by Federal designated or proposed threatened or endangered species National Preserve (terrestrial) National or State terrestrial Wildlife Refuge Federal land designated for protection of natural ecosystems Administratively proposed Federal Wilderness Area Terrestrial areas utilized by large or dense aggregations of animals (vertebrate species) for breeding	75
	Terrestrial habitat used by State designated endangered or threatened species Terrestrial habitat used by species under review for Federal designated endangered or threatened status	50
	State lands designated for wildlife or game management State designated Natural Areas Particular areas, relatively small in size, important to maintenance of unique biotic communities	25

* - Check (✓) all environments impacted or potentially impacted by the site

Notes:

**SI TABLE 17 (HRS TABLE 5-6);
ATTRACTIVENESS/ACCESSIBILITY VALUES**

*	AREA OF OBSERVED CONTAMINATION	ASSIGNED VALUE
	Designated recreational area	100
	Regularly used for public recreation (for example, vacant lots in urban area)	75
	Accessible and unique recreational area (for example, vacant lots in urban area)	75
	Moderately accessible (may have some access improvements for example, gravel road) with some public recreation use	50
	Slightly accessible (for example, extremely rural area with no road improvement) with some public recreation use	25
✓	Accessible with no public recreation use	10
	Surrounded by maintained fence or combination of maintained fence and natural barriers	5
	Physically inaccessible to public, with no evidence of public recreation use	0

* Check (✓) highest value.

**SI TABLE 18 (HRS TABLE 5-7): AREA OF CONTAMINATION FACTOR
VALUES**

*	TOTAL AREA OF THE AREAS OF OBSERVED CONTAMINATION (SQUARE FEET)	ASSIGNED VALUE
	≤ to 5,000	5
	> 5,000 to 125,000	20
	> 125,000 to 250,000	40
	> 250,000 to 375,000	60
	> 375,000 to 500,000	80
	> 500,000	100

* Check (✓) highest value.

Notes: The areal extent of the Roy Bros property will be considered as potentially contaminated in SI Table 18. The total area of the Roy Bros property is 4.4 acres, or 191,664 square feet [50].

SI TABLE 19 (HRS TABLE 5-8): NEARBY POPULATION LIKELIHOOD OF EXPOSURE FACTOR VALUES

Area of Contamination Factor Value	Attractiveness/Accessibility Factor Value						
	100	75	50	25	10	5	0
100	500	500	375	250	125	50	0
80	500	375	250	125	50	25	0
60	375	250	125	50	25	5	0
40	250	125	50	25	5	5	0
20	125	50	25	5	5	5	0
5	50	25	5	5	5	5	0

SI TABLE 20 (HRS TABLE 5-10): DISTANCE-WEIGHTED POPULATION VALUES FOR NEARBY POPULATION THREAT

Travel Distance Category (miles)	Pop.	NUMBER OF PEOPLE WITHIN THE TRAVEL DISTANCE CATEGORY												Pop. Value
		0	1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	
Greater than 0 to 1/4	416	0	0.1	0.4	1.0	4	13	41	130	408	1,303	4,081	13,034	13
Greater than 1/4 to 1/2	1257	0	0.05	0.2	0.7	2	7	20	65	204	652	2,041	6,517	20
Greater than 1/2 to 1	4092	0	0.02	0.1	0.3	1	3	10	33	102	326	1,020	3,258	33
Sum =														66

References: 17
Notes:

SOIL EXPOSURE PATHWAY WORKSHEET (Concluded)

WASTE CHARACTERISTICS

		Score																																	
10.	Assign the hazardous waste quantity score calculated for soil exposure	10,000																																	
11.	Assign the highest toxicity value from SI Table 15a.																																		
	Substance(s): <u>Chlorobenzene</u> <u>Pyrene</u> <u>Fluoranthrene</u>																																		
	Value: <u>100</u> <u>100</u> <u>100</u>																																		
	From Table: <u>15a</u> <u>15a</u> <u>15a</u>																																		
12.	Multiply the toxicity and hazardous waste quantity scores. Assign the Waste Characteristics score from the table below:	1E+06																																	
<table border="1"> <thead> <tr> <th>Product</th> <th>WC Score</th> <th>*</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td></td> </tr> <tr> <td>>0 to <10</td> <td>1</td> <td></td> </tr> <tr> <td>≥10 to <100</td> <td>2</td> <td></td> </tr> <tr> <td>≥100 to <1,000</td> <td>3</td> <td></td> </tr> <tr> <td>≥1,000 to <10,000</td> <td>6</td> <td></td> </tr> <tr> <td>≥10,000 to <1E+05</td> <td>10</td> <td></td> </tr> <tr> <td>≥1E+05 to <1E+06</td> <td>18</td> <td></td> </tr> <tr> <td>≥1E+06 to <1E+07</td> <td>32</td> <td>✓</td> </tr> <tr> <td>≥1E+07 to <1E+08</td> <td>56</td> <td></td> </tr> <tr> <td>≥1E+08 or greater</td> <td>100</td> <td></td> </tr> </tbody> </table> <p>*check (✓) the WC score calculated for the pathway</p>		Product	WC Score	*	0	0		>0 to <10	1		≥10 to <100	2		≥100 to <1,000	3		≥1,000 to <10,000	6		≥10,000 to <1E+05	10		≥1E+05 to <1E+06	18		≥1E+06 to <1E+07	32	✓	≥1E+07 to <1E+08	56		≥1E+08 or greater	100		
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≥1E+06 to <1E+07	32	✓																																	
≥1E+07 to <1E+08	56																																		
≥1E+08 or greater	100																																		
WC =		32																																	

RESIDENT POPULATION THREAT SCORE:

(Likelihood of Exposure, Question 1;
Targets = Sum of Questions 2, 3, 4, 5, 6)

$$\frac{550 \times 5 \times 32}{82,500} =$$

1.06

NEARBY POPULATION THREAT SCORE:

(Likelihood of Exposure, Question 7;
Targets = Sum of Questions 8,9)

$$\frac{5 \times 7.6 \times 32}{82,500} =$$

0.0147

SOIL EXPOSURE PATHWAY CALCULATION:

Resident Population Threat + Nearby Population Threat =

1.08

(Maximum of 100)

Notes:

AIR MIGRATION PATHWAY

Pathway Description and Scoring Notes: Describe the Air Migration Pathway. Identify the nearest potential receptors of airborne contaminants and the population residing within four miles of the site. Identify any sensitive environments located within the target distance limit.

Briefly discuss any sampling events relative to the Air Pathway; provide dates of sampling events and a summary of the analytical results and whether an observed release and/or actual contamination targets were documented.

Indicate any assumptions you have made in scoring the Air Pathway for this site, or any key factors which influenced your scoring rationale.

There are 50 workers employed by Roy Bros [2, p.2]. The nearest residential property is located along Allen Road in Billerica, approximately 210 feet southwest of the former western infiltration lagoon [2, p.12]. There are no schools or day-care facilities within 200 feet of the Roy Bros property. An estimated 81,724 people are located within 4-radial miles of the property [17; 61; 62; 63].

During the 20 September 1995 START on-site reconnaissance, no measurements above background levels were detected by air monitoring instruments [2, pp. 1-9]. During the 19 December 1995 START sediment sampling, air monitoring instruments detected measurements at levels ranging between 5 and 100 units above background at sediment sample locations SD-01, SD-02, SD-03, SD-07, and SD-08 [2, pp. 1-23].

Federally listed or proposed threatened and endangered species are known to occur within a 4-mile radius of the Roy Bros property [49]. Approximately 1,600 acres of wetlands are located within 4-radial miles of the property. Wetland acres were estimated using Department of the Interior Wetland Inventory Maps for Billerica, Boston North, Maynard, and Reading Quadrangles [2; 5; 82; 83; 84].

No previous air sampling has been conducted at this site.

Note: Mobility equals 1 for all observed release substances.

Notes:

Note: Convert all results and SCDM values to $\mu\text{g}/\text{m}^3$ or ppb.

If sum of percents calculated for I or J index is $\geq 100\%$, consider the targets as Level I, if the sum of I or J index is $< 100\%$ consider the targets as Level II.

Sample ID:

11 July 1996

AIR PATHWAY WORKSHEET

LIKELIHOOD OF RELEASE

	Score	Data Type	Refs
1. OBSERVED RELEASE: If sampling data or direct observation support a release to air, assign a score of 550. Record observed release substances on SI Table 21.			
2. POTENTIAL TO RELEASE: If sampling data do not support a release to the air, assign a score of 500. Optionally, evaluate air migration gaseous and particulate potential to release (HRS Section 6.1.2).	500	+	1,2
LR = 500			

TARGETS

3. ACTUAL CONTAMINATION POPULATION: Determine the number of people within the target distance limit subject to exposure from a release of a hazardous substance to the air. Level I: <u>0</u> people $\times 10 = 0$ Level II: <u>0</u> people $\times 1 = 0$ Total = 0	0		2												
4. POTENTIAL TARGET POPULATION: Determine the number of people within the target distance limit not subject to exposure from a release of a hazardous substance to the air using SI Table 22. Sum the values and multiply by 0.1.	54.9	+	17												
5. NEAREST INDIVIDUAL: Assign a score of 50 if there are any Level I targets. Assign a score of 45 if there are Level II targets but no Level I targets. If no Actual Contamination Population exists, assign the Nearest Individual score from SI Table 22.	20	+	17												
6. ACTUAL CONTAMINATION SENSITIVE ENVIRONMENTS: Sum the sensitive environment values (SI Table 13) and wetland acreage values (SI Table 23) for environments subject to exposure from the release of a hazardous substance to the air. <table><tr><td>Sensitive Environment Type</td><td>Value</td></tr><tr><td>None</td><td>0</td></tr><tr><td></td><td></td></tr><tr><td>Wetland Acreage</td><td>Value</td></tr><tr><td>None</td><td>0</td></tr><tr><td></td><td></td></tr></table>	Sensitive Environment Type	Value	None	0			Wetland Acreage	Value	None	0			0 0	+	1,2 1,2
Sensitive Environment Type	Value														
None	0														
Wetland Acreage	Value														
None	0														
7. POTENTIAL CONTAMINATION SENSITIVE ENVIRONMENTS: Use SI Table 24 to evaluate sensitive environments not subject to exposure from a release.	4.024	+	3,49,61 62,63												
8. RESOURCES: Assign a score of 5 if one or more air resources applies within 1/2 mile of a source; assign a 0 if none applies • Commercial agriculture • Commercial silviculture • Major or designated recreation area	5	+	3,61 62,63												
Sum of Targets T =	83.924														

Notes:

AIR PATHWAY WORKSHEET (Continued)

WASTE CHARACTERISTICS

	Score																																	
<p>9. If any Actual Contamination Targets exist for the air pathway, assign the calculated hazardous waste quantity score or a score of 100, whichever is greater; if there are no Actual Contamination Targets for the air pathway, assign the calculated HWQ score for sources available for air migration.</p>	10,000																																	
<p>10. Assign the highest air toxicity/mobility value from SI Table 2a or SI Table 3.</p> <p>Substance(s): <u>Vinyl chloride</u></p> <p>Value: <u>10,000</u></p> <p>From Table: <u>3</u></p>	10,000																																	
<p>11. Multiply the toxicity and hazardous waste quantity scores. Assign the Waste Characteristics score from the table below:</p> <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Product</th> <th>WC Score</th> <th>*</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td></td></tr> <tr><td>>0 to <10</td><td>1</td><td></td></tr> <tr><td>≥10 to <100</td><td>2</td><td></td></tr> <tr><td>≥100 to <1,000</td><td>3</td><td></td></tr> <tr><td>≥1,000 to <10,000</td><td>6</td><td></td></tr> <tr><td>≥10,000 to <1E+05</td><td>10</td><td></td></tr> <tr><td>≥1E+05 to <1E+06</td><td>18</td><td></td></tr> <tr><td>≥1E+06 to <1E+07</td><td>32</td><td></td></tr> <tr><td>≥1E+07 to <1E+08</td><td>56</td><td></td></tr> <tr><td>≥1E+08 or greater</td><td>100</td><td>✓</td></tr> </tbody> </table> <p style="font-size: small;">*check (✓) the WC score calculated for the pathway</p>	Product	WC Score	*	0	0		>0 to <10	1		≥10 to <100	2		≥100 to <1,000	3		≥1,000 to <10,000	6		≥10,000 to <1E+05	10		≥1E+05 to <1E+06	18		≥1E+06 to <1E+07	32		≥1E+07 to <1E+08	56		≥1E+08 or greater	100	✓	1E+08
Product	WC Score	*																																
0	0																																	
>0 to <10	1																																	
≥10 to <100	2																																	
≥100 to <1,000	3																																	
≥1,000 to <10,000	6																																	
≥10,000 to <1E+05	10																																	
≥1E+05 to <1E+06	18																																	
≥1E+06 to <1E+07	32																																	
≥1E+07 to <1E+08	56																																	
≥1E+08 or greater	100	✓																																
WC =	100																																	

Multiply LR by T and by WC. Divide the product by 82,500 to obtain the air migration pathway score. If the pathway score is greater than 100, assign 100.

AIR MIGRATION PATHWAY CALCULATION:

$$\frac{500 \times 83.924 \times 100}{82,500} =$$

50.86

(Maximum of 100)

Notes:

SI TABLE 22 (FROM HRS TABLE 6-17): VALUES FOR POTENTIAL CONTAMINATION AIR TARGET POPULATIONS

Distance From Site	Pop.	Nearest Individual (choose highest)	NUMBER OF PEOPLE WITHIN THE DISTANCE CATEGORY													Pop. Value
			1 to 10	11 to 30	31 to 100	101 to 300	301 to 1000	1001 to 3000	3001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,000 to 3,000,000		
On a source	50	20	4	17	53	164	522	1,638	5,214	16,325	52,137	163,246	521,360	1,632,455	53	
0 to 1/4 mile	416	*	1	4	13	41	131	408	1,304	4,081	13,034	40,812	130,340	408,114	131	
> 1/4 to 1/2 mile	1,257	2	0.2	0.9	3	9	28	88	282	882	2,815	8,815	28,153	88,153	88	
> 1/2 to 1 mile	4,092	1	0.06	0.3	0.9	3	8	26	83	261	834	2,612	8,342	26,119	83	
> 1 to 2 miles	17,215	0	0.02	0.09	0.3	0.8	3	8	27	83	266	833	2,659	8,326	83	
> 2 to 3 miles	24,741	0	0.009	0.04	0.1	0.4	1	4	12	38	120	375	1,199	3,755	38	
> 3 to 4 miles	34,002	0	0.005	0.02	0.07	0.2	0.7	2	7	28	73	229	730	2,285	73	
Nearest Individual =		20	Sum =													549

*Score = 20 if the Nearest Individual is within 1/8 mile of a source; score = 7 if the Nearest Individual is between 1/8 and 1/4 mile of a source.

References: 2,17

Notes:

**SI TABLE 23 (HRS TABLE
6-18): AIR PATHWAY
VALUES FOR WETLAND AREA**

*	WETLAND AREA	ASSIGNED VALUE
	< 1 acre	0
	1 to 50 acres	25
	> 50 to 100 acres	75
	> 100 to 150 acres	125
	> 150 to 200 acres	175
	> 200 to 300 acres	250
	> 300 to 400 acres	350
	> 400 to 500 acres	450
✓	> 500 acres	500

**SI TABLE 24: DISTANCE WEIGHTS AND
CALCULATIONS FOR AIR PATHWAY POTENTIAL
CONTAMINATION SENSITIVE ENVIRONMENTS**

DISTANCE	DISTANCE WEIGHT	SENSITIVE ENVIRONMENT TYPE AND VALUE (FROM SI TABLES 13 AND 23)	PRODUCT
On a Source	0.10	× 25 Wetland	2.5
		×	
0 to 1/4 mile	0.025	× 25 Wetland	0.625
		×	
		×	
1/4 to 1/2 mile	0.0054	× 75 Wetland	0.405
		×	
		×	
1/2 to 1 mile	0.0016	× 75 Wetland	0.12
		×	
1 to 2 miles	0.0005	× 350 Wetland	0.175
		×	
2 to 3 miles	0.00023	× 500 Wetland	0.115
		×	
3 to 4 miles	0.00014	× 500 Wetland	0.084
		× 50 Federal Endangered Candidate (2)	
> 4 miles	0	×	0
Total Environments Score =			4.024

Notes:

SITE SCORE CALCULATION

	S	S'
GROUNDWATER PATHWAY SCORE (S_{GW})	100	10,000
SURFACE WATER PATHWAY SCORE (S_{SW})	100	10,000
SOIL EXPOSURE PATHWAY SCORE (S_{SE})	1.08	1.16
AIR PATHWAY SCORE (S_A)	50.86	2,586.74
SITE SCORE	$\sqrt{\frac{S_{GW}^2 + S_{SW}^2 + S_{SE}^2 + S_A^2}{4}} =$	
	75.15	

COMMENTS:

WARNING!!

EPA has determined that the HRS score of any site that is progressing towards listing on the NPL is confidential. Deliberations regarding scoring or listing issues, the site specific status, and HRS scores cannot be released or discussed with non-Agency persons. For additional guidance see the April 30, 1993 OSWER Directive 9320.1-11.

ROY BROS HAULERS

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617-229-6430 • Fax 617-272-3619

SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM
EPA CONTRACT 68-W5-0009

1 July 1996
11098-011-001-1055-50
DC No. A-456

Ms. Sharon M. Hayes
Task Monitor
U.S. EPA-New England
Superfund Support Section (HBS)
John F. Kennedy Federal Building
Boston, MA 02203-2211

Subject: Draft Site Inspection Prioritization Report
Roy Bros Haulers
Billerica, Massachusetts
CERCLIS No. MAD009870643
TDD No. 95-06-0006

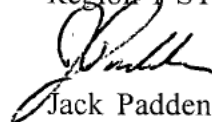
Dear Ms. Hayes:

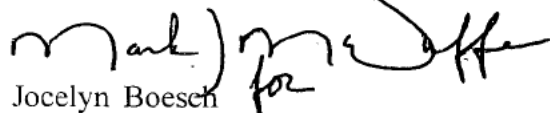
Enclosed is one copy of the Draft Site Inspection Prioritization Report for the Roy Bros Haulers property in Billerica, Massachusetts. One copy of the draft report has been sent to the Massachusetts Department of Environmental Protection in Boston. Comments are due to Roy F. Weston, Inc. (WESTON®) by 12 August 1996, six weeks after the submission of this document. The Draft Site Inspection Prioritization Report was prepared in response to TDD No. 95-06-0006.

Please contact the undersigned at (617) 229-6430 if you have any questions regarding this report.

Very truly yours,

ROY F. WESTON, INC.
Region I START


Jack Padden
Site Leader


Jocelyn Boesch
Project Leader

jap
Enclosure

S:\95060006\ROYBROS.DFT



Roy F. Weston, Inc.
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SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM
EPA CONTRACT 68-W5-0009

1 July 1996
11098-011-001-1055-50
DC No. A-456

Mr. Harish Panchal
Bureau of Waste Site Cleanup
Department of Environmental Protection
One Winter Street
Boston, MA 02108

Subject: Draft Site Inspection Prioritization Report
Roy Bros Haulers
Billerica, Massachusetts
CERCLIS No. MAD0009870643
TDD No. 95-06-0006

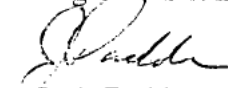
Dear Mr. Panchal:

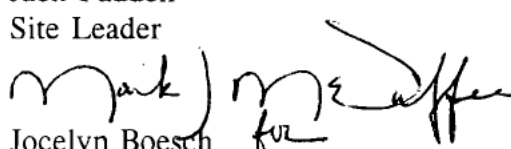
Enclosed is one copy of the Draft Site Inspection Prioritization Report for the Roy Bros Haulers property in Billerica, Massachusetts. Comments are due by 12 August 1996, six weeks after the submission of this document and should be directed in writing on or before this date to Ms. Nancy Smith, U.S. EPA-New England Site Assessment Manager.

Please contact the undersigned at (617) 229-6430 if you have any questions regarding this report.

Very truly yours,

ROY F. WESTON, INC.
Region I START


Jack Padden
Site Leader


Jocelyn Boesch
Project Leader

jap

Enclosure

cc: ~~S. Hayes~~ (EPA Task Monitor)
N. Smith (EPA Site Assessment Manager)

SA95060006/ROYBROS.DFT